Technical Report 928

Costs and Errors in Survey Sample Design: An Application to Army Prospect and Recruit Surveys

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This report discusses the implications of survey costs and sampling errors for the design of marketing, program evaluation, and sales satisfaction surveys used in Army recruiting. The first section gives an overview of relevant research on the recruitment process, describes survey populations at different stages of recruiting, and identifies major variables that affect sample designs and survey content. The second section examines the effect of seasonality on survey response and sampling and presents results of data analyses. The third section presents a general model of costs and errors in survey sampling for four stages of the recruiting process: initial appointments, applications, contracts, and accessions. The fourth section discusses application of the model to ongoing surveys at all four stages of the recruitment process. In particular, the costs, benefits, errors, applicability, and practicability of alternative sampling plans are described.

This report is the first of two reports on this subject. The second (McGuire, 1991; in preparation) contains the User's Manual for a prototype Lotus 1-2-3 spreadsheet designed to examine tradeoffs between survey costs and sampling errors.

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FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research to enhance recruiting of Army personnel and to develop more cost-effective recruiting policies and practices for the Army. Survey research is an important source of information to achieve these objectives.

This report documents research that examines possible sampling plans and strategies for use in Army surveys of recruits and prospects. It provides an overview of the recruiting process, summarizes previous research, and discusses the advantages and disadvantages of alternative survey methods and sampling strategies. The report also describes the results of analyses conducted to investigate issues of sample representativeness in the ongoing New Recruit Surveys.

This work is part of the mission of the Manpower and Personnel Policy Research Group (MPPRG) to conduct research to improve the Army's recruiting capabilities. The project was prioritized by the U.S. Army Recruiting Command (USAREC) Command Studies Advisory Group, and requested by Colonel Heimericks, Director of Program Analysis and Evaluation, USAREC. Preliminary results were briefed to Major Bradford, Advertising Research and Analysis, USARCPAE, on 20 September 1990.

The results reported here will aid USAREC in designing the best survey sampling methods. They will ensure that surveys of Army recruits and prospects provide the most accurate information, in the most cost-effective manner, for Army policy makers and personnel planners.

EDGAR M. JOHNSON
Technical Director

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We gratefully acknowledge the assistance and information provided by Dr. Timothy W. Elig and Ms. Mary Sue Hay of the U.S. Army Research Institute for the Behavioral and Social Sciences and Major Don F. Bradford of the U.S. Army Recruiting Command. We also wish to thank Ms. Hay and Kathy Lillie for their invaluable assistance in securing and organizing the data for analyses. Finally, we wish to thank Dr. Paul Novak and Deb Skophammer of Personnel Decisions Research Institutes, Inc., for their administrative assistance.

COSTS AND ERRORS IN SURVEY SAMPLE DESIGN: AN APPLICATION TO ARMY PROSPECT AND RECRUIT SURVEYS

EXECUTIVE SUMMARY

Requirement:

Maintaining high standards of military recruiting requires up-to-date information concerning prospects' and recruits' attitudes toward recruiting advertisements, incentives, and practices. One important approach to gathering this information has been the use of prospect and recruit surveys. To ensure that inferences based on survey information are accurate and reliable, surveys need to employ scientific sampling designs. The purpose of this project was to examine alternative survey methods and sampling procedures.

Procedure:

First we conducted a literature search and review of the Army recruitment process. Next, in order to examine seasonal variations in characteristics and responses of Army accessions, we extended previous analyses of data from the New Recruit Surveys to a third year. The third stage of the project involved a careful consideration of the costs and errors of surveys at four points of the recruitment process: appointments, applications, contracts, and accessions. Finally, we developed a general approach to specifying costs and errors for specific combinations of survey methods and sampling strategies.

Findings:

The literature review organized the extant literature into considerations of recruiting outcomes (dependent variables), recruit activities (independent variables), and market segments (moderating variables). The significant effects of many of these variables upon enlistment outcomes strongly suggest that these variables be monitored and controlled in studies of enlistment decisions, including studies involving surveys. Further, the literature review identified several major variables and issues to consider when sampling prospect and recruit populations.

Analyses of data from the New Recruit Surveys detected several important seasonal variations in Army accessions. These present additional issues to consider in designing surveys of Army prospects and recruits.

We considered applicability, practicability, costs, errors, and benefits to isolate sets of possible sampling designs for prospect and recruit surveys. These general considerations were incorporated into a prototype spreadsheet. The spreadsheet prototype is intended to be used to examine tradeoffs between survey costs and sampling errors for specific combinations of survey methods and sampling plans.

Utilization of Findings:

The information presented in this report and in the spreadsheet prototype will be used by survey designers in the U.S. Army Research Institute for the Behavioral and Social Sciences and the U.S. Army Recruiting Command to assess alternative approaches to gathering survey information and to aid and support decisions regarding specific survey designs.

COSTS AND ERRORS IN SURVEY SAMPLE DESIGN: AN APPLICATION TO ARMY PROSPECT AND RECRUIT SURVEYS

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COSTS AND ERRORS IN SURVEY SAMPLE DESIGN: AN APPLICATION TO ARMY PROSPECT AND RECRUIT SURVEYS

The overall goal of this research effort is to develop sampling models that could be used to design sampling frames and specifications for Army surveys of prospects making initial appointments with recruiters, formally applying for enlistment, and contracting for service, and accessioning into the Army. These sampling models incorporate survey costs and sampling errors that could affect survey design decisions.

The purpose of this report is to discuss sampling designs for Army prospect and recruit surveys and to discuss the implications of these designs for the development of a computer spreadsheet that incorporates a model for surveying Army prospects and recruits. These tasks include (1) a general assessment of the costs and errors in survey sampling for the four points in this process (initial appointments, applications, contracts, and accessions); (2) a general assessment of the costs, errors, benefits, applicability, and practicability of survey methods and techniques for prospect and recruit sample surveys; (3) application of the general model to the specifics of two situations: on-going surveys of accessions at all eight Army entry points, and contemplated computer-administered surveys at all Army recruiting stations; and (4) the development of specific models for at least two sampling points that can be used to estimate costs and errors of sample sizes, sampling techniques, and data collection methodologies. The model is incorporated into a Lotus 1-2-3 spreadsheet and documented in a user's manual (McGuire, in preparation).

The first section of this report provides an overview of the recruitment process and the research literature related to it. The purpose of this section is to describe the general background, constraints, and results of previous Army recruitment survey research. Next, the results of data analyses examining issues of representativeness of survey samples across seasons are presented and discussed. The report then discusses a general model of costs and errors in survey sampling for initial appointments, applications, contracts, and accessions. Several issues are generally addressed: the relative importance of survey research on the recruitment process, sources of survey costs by stage of survey sampling, and sources of errors by stage of survey sampling. The next section discusses the application of the model to on-going surveys at all four stages of the recruitment process. In particular we consider the costs, benefits, errors, applicability, and practicability of alternative sampling plans. The final section of this report presents and discusses a prototype spreadsheet that eventually will be able to generate estimates of the economic costs and sampling errors of a given survey using a given sampling design.

An Overview of the Army Recruiting Process

In this section, we review the background, organizational structure, and recruitment process of the U.S. Army Recruiting Command (USAREC). The purpose of this overview is to describe the context in which Army survey research occurs and thereby identify factors that are important to sampling design decisions. The selection of sampling designs for personnel surveys depends critically upon situational constraints within the Army and the survey purposes of USAREC. Additionally, this information may serve as an introductory primer about Army recruiting practices for other researchers.

Background

Recruiting qualified personnel into entry level positions is an important challenge for any organization. As one of the largest employers of the nation's youth, recruiting for the U.S. Army is especially challenging. The Army, through its recruiting command, must enlist about 200,000 new recruits each year (including active duty and the Army Reserves) into dozens of different entry level jobs (USAREC, 1989). The Army is the largest of the nation's military services, maintaining an active duty strength of about 770,000 (USAREC, 1989).

There are several factors that contribute to the complexity of the Army's recruiting mission. In addition to the sheer volume of recruits needed, changes in military strategy, tactics, and technology produce changes in the job requirements and recruiting objectives for specific job types (e.g., the number of nurses needed). The size of the Army can vary considerably, increasing with rises in world tensions and potential conflicts and decreasing with reductions in the nature of the security threats. These changes, set by congressional policy, can occur on relatively short notice.

There are several exogenous variables that also affect recruiting policies and practices. The economic conditions of the country produce marked effects upon the supply of potential recruits. Strong levels of employment and comparatively higher levels of pay in the private sector significantly increase the challenge associated with recruiting the requisite quality and quantity of recruits (Cotterman, 1986; Polich, Dertouzos & Press, 1986). Additionally, the availability of quality prospects varies with the season of the year (Hay, 1990).

In order to meet the challenges of attracting sufficient numbers of quality recruits, the U.S. Congress has authorized several enlistment incentive programs. For example, cash bonuses and college scholarships are available for enlisting high quality recruits into certain job specialties (Polich et al., 1986; Polich, Fernandez, & Orvis, 1982).

In summary, the size, complexity, and cost of recruiting combined with strong competition for potential recruits makes recruiting a challenging endeavor. Obtaining accurate, up-to-date information about the availability, circumstances, and motivations of Army prospects and recruits is important for adapting advertising and incentive programs to the changing needs and conditions of the labor market. Hence, survey information is an essential component of sound, cost-effective management of the recruiting process. In order to understand how survey research can influence the recruiting process, we need to take into consideration the structure and management of the recruitment process.

Organization and Structure

The U.S. Army Recruiting Command was formed to meet the recruiting requirements of the U.S. Army. USAREC has over 8,000 local recruiters located in about 2,000 recruiting stations distributed throughout the United States, Puerto Rico, Guam, American Samoa, and military bases throughout the world (USAREC, 1989). The geographical boundaries of the recruiting stations are primarily based upon providing an approximately equal distribution of the applicant pool to each station. The workload of each recruiting station is further balanced through the number of recruiters working in each station. This number varies from 1 to 7, with an average of 4 recruiters.

The organizational structure of USAREC follows that of other Army commands. It consists of 5 tiers--recruiting stations, companies, battalions, brigades, and headquarters. This structure is graphically represented in Figure 1.

The battalion, brigade, and headquarters levels manage the direction and scope of recruiting resources. For example, each of these organizational levels contain staff functions, or departments, which analyze and recommend the allocation of advertising and public awareness resources. The battalion allocates local advertising funds and selects local media. Headquarters allocates national level advertising and selects national media. The brigade level participates in both local and national advertising decisions, as well as conducting extensive market analyses. From the standpoint of survey research, this suggests that survey sampling, analyses, and reporting of results should be broken down to at least the brigade level (T. Elig, personal communication, 1990). Where feasible, of course, information at the battalion, company, recruiting station, and even zip code level is useful.

Recruiting Process

In this section we describe the recruiting process. This information provides a background for assessing the applicability and practicality of sampling and surveying prospects and recruits at different stages of the recruiting process. The recruiting

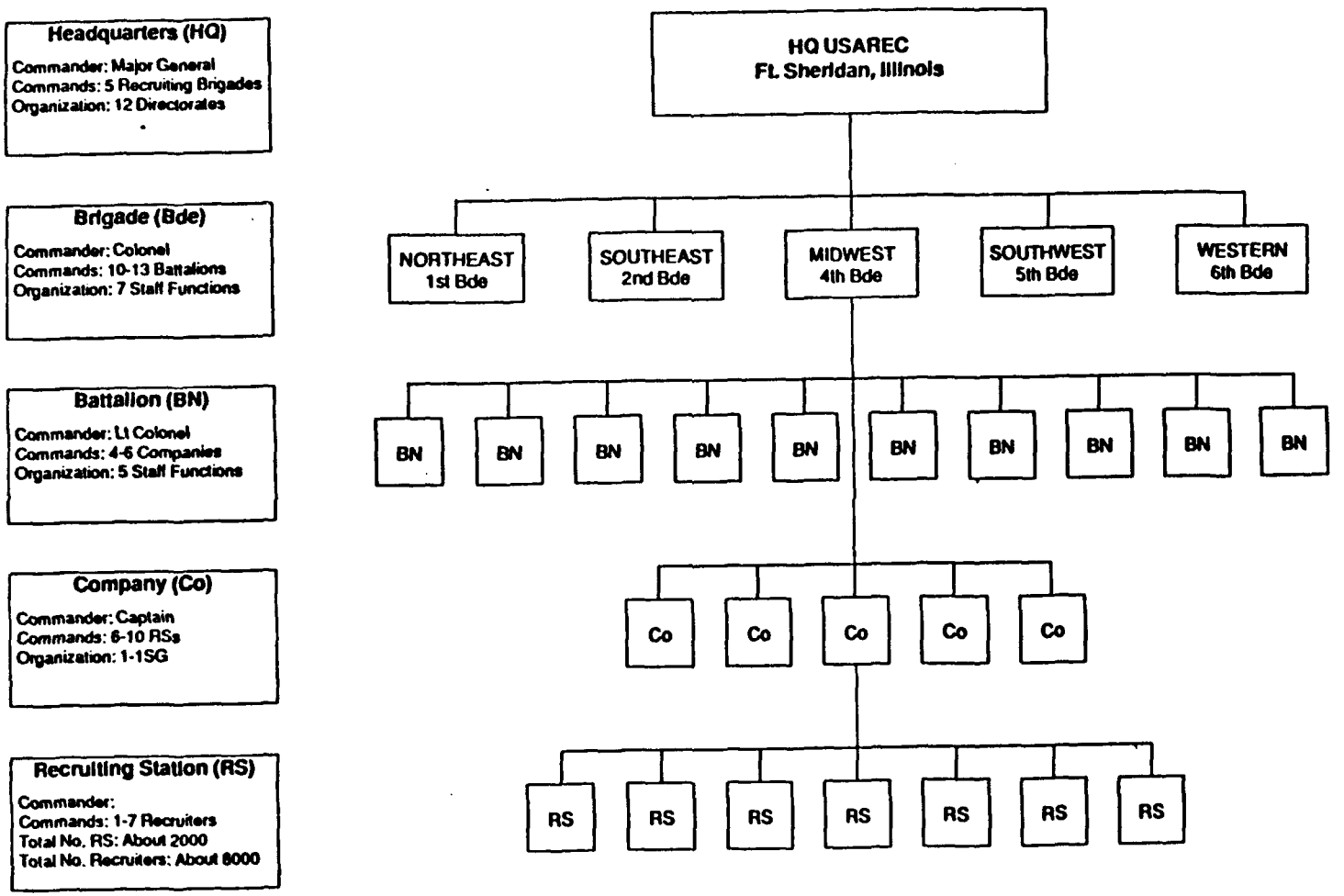

Figure 1. Organizational structure for USAREC. (Note that only a portion of the battalions, companies, and recruiting stations are represented here.)

process is described in terms of the activities conducted by the U.S. Army Recruiting Command.

The recruiting process consists of seven stages--from providing prospective recruits with an awareness of Army opportunities through accessing at the reception battalion for their first day of Army service. These stages are depicted in Figure 2.

The first stage of the recruitment process is creating an awareness of Army opportunities in the eligible population. The target audience is primarily 17 to 24 year old males (additional demographic information concerning Army prospects is provided in the next section). This awareness is created through a variety of advertising and public relations methods. As previously mentioned, USAREC Headquarters coordinates an extensive national advertising campaign, consisting of television and radio commercials, magazine advertisements and inserts, direct mail, and an 800 number telephone information service. USAREC brigades and battalions direct similar efforts on the regional and local levels. They utilize local newspaper and radio advertising and coordinate public relation efforts such as technical displays, Army medical team visits, and Golden Knight parachute team exhibitions at air shows. A primary purpose of all public relations activities is to generate leads for the recruiters. For example, when inquiries are received from the 800 telephone number or from direct mail or magazine cards, these leads are provided to local recruiters.

Recruiters follow-up the leads by contacting prospects by telephone. Lead generation activities are also conducted directly by recruiters. They obtain referrals from prospects, high school counselors and coaches, and from other sources developed through community involvement activities. These activities can include school presentations, awards (United States Army Reserve Scholar/Athlete Award, Junior Reserve Officers Training School, etc.), or scheduling the administration of the Armed Services Vocational Aptitude Battery (ASVAB) at the school. The objective of these initial contacts, known as 'prospecting', is to schedule appointments for sales interviews.

Sales interview appointments, the third stage of the process, can be conducted at the prospect's home, a neutral site, or at the recruiting station. Recruiters utilize standard sales procedures of determining the prospects' needs and interests, presenting features and benefits of Army enlistment, pre-qualifying, handling objections, and closing the sale.

For those interested in enlisting, the application process begins with the recruiter pre-screening the prospect for mental, physical, and moral qualifications. From this information, the recruiter prepares the prospect's enlistment packet. This information is verified by the recruiter through, for example,

Recruiting Activities

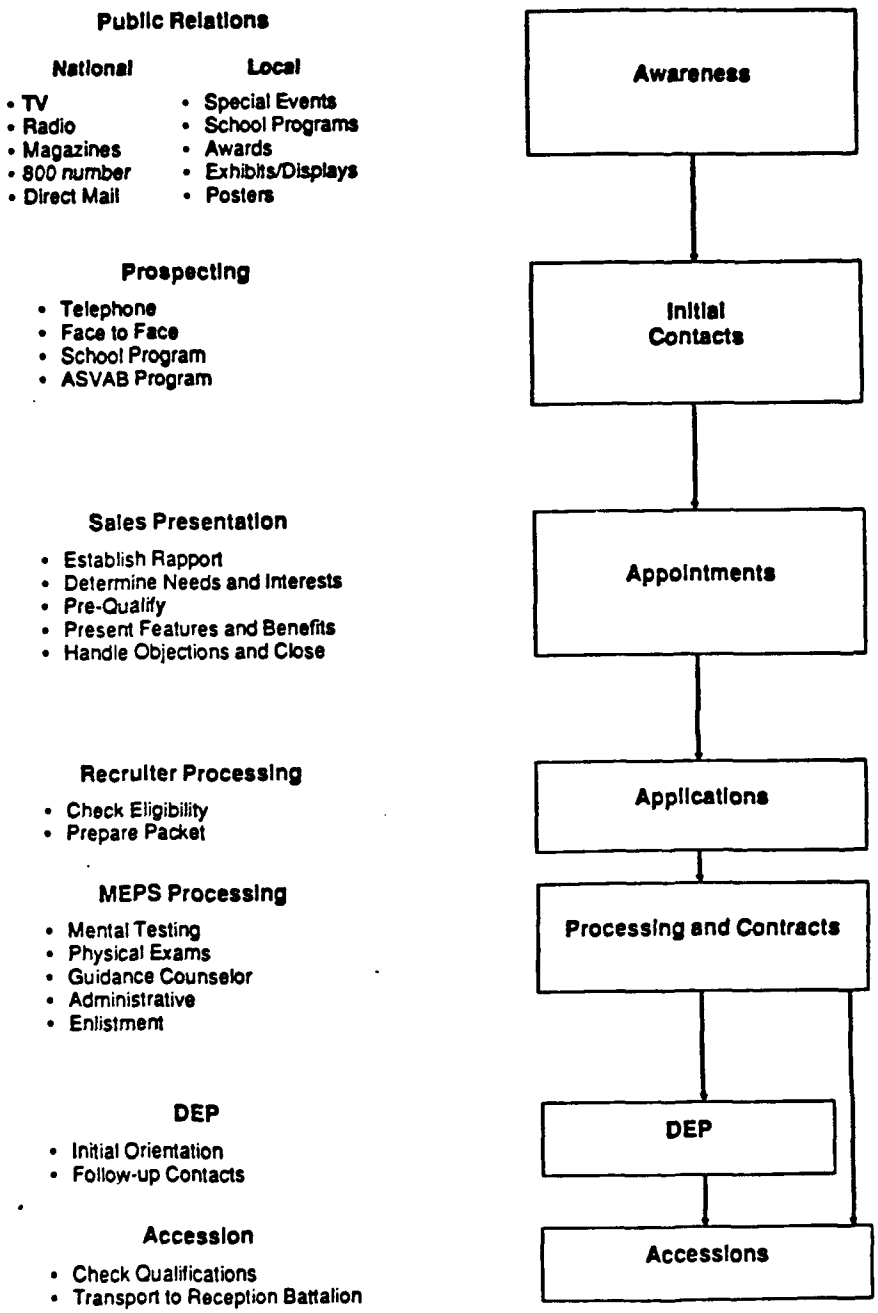

Figure 2. Recruiting activities for the U.S. Army

checking education records with the school, checking the social security number, etc.

The next recruiting step is to schedule the prospect for the mental examinations--the Armed Services Vocational Aptitude Battery, or ASVAB. Scores from the ASVAB are used to determine minimum qualifications, and eligibility for Army jobs and certain enlistment incentives. Recruiters can schedule prospects to take this test at a mobile testing station, their school, or at the Military Entrance Processing Station (MEPS). After successful completion of the ASVAB, additional processing is conducted by the MEPS. Recruits undergo a physical examination, and meet with a guidance counselor (GC) to discuss job opportunities and enlistment options (e.g., bonuses, educational scholarships).

It is important to note that the MEPS is part of a separate Department of Defense command, USMEPCOM, which is staffed by all four military branches. MEPS processing involves travel for many prospects, since there are about 80 MEPS stations to serve the thousands of recruiting stations for all of the services.

After discussing enlistment options, the guidance counselor presents the prospect with an enlistment contract. The contract specifies the term of enlistment, the job (military occupational specialty, or MOS) the recruit will be trained for, and the date of entry. The recruit can enter immediately (direct accession), or can delay entry for a few weeks or months, up to as much as a year. This latter option is known as the delayed entry program, or DEP.

When recruits enter the DEP, the recruiter provides them with an initial orientation, usually within the first three days of entry. This orientation discusses their enlistment options and provides additional information about basic training, Army life, etc. Recruiters maintain regular contact with their recruits in DEP and serves, in effect, as their squad leader.

The seventh and final stage in the recruiting process is in accessing recruits into active duty. These arrangements are made by the MEPS and involve re-checking qualifications (including a medical inspection) and documentation, and arranging transportation to the appropriate Army reception battalion. Given this basic description of the recruitment process, we review relevant research on Army recruitment in the next section.

Literature Review of the Army Recruitment Process

In this section, we summarize research on the Army recruitment process. This research summary provides important background for what is known about the variables which affect Army recruitment and which therefore need to be identified and considered in survey and sampling design decisions. Furthermore, the literature review provides a framework for identifying

possible sources of error to consider when interpreting survey results.

The studies on recruitment are organized into three subsections: (1) enlistment decisions; (2) recruiting activities; and (3) market segmentation. This organization corresponds to three key activities for managing the recruiting process--monitoring recruiting outcomes, directing recruiting activities and resources, and adapting the approach and resources to market segments. From the scientific perspective, this is the familiar organization of reviewing the dependent, independent, and moderating variables, respectively. The literature search activities involved: (a) conducting several computerized searches of the PSYCHINFO databases (the psychology and NTIS indexes); (b) checking reference sections of relevant journal articles and technical reports; and (c) contacting Army recruiting experts (MAJ Bradford of USAREC, Dr. Elig and Ms. Hay of ARI, and Dr. Borman of PDRI).

Enlistment Decisions (Dependent Variables)

The focus of most Army recruitment research is upon the enlistment outcome--whether a person enlists or does not enlist. From the organization's perspective, the purposes for this focus involve interests in improving the efficiency of recruiting (e.g., reducing costs) and in identifying potential sources for additional recruits among the qualified losses (Berryman, Bell, & Lisowski, 1983).

Conceptually, enlistment outcomes can be differentiated based upon the stage of the recruiting process and upon the nature of the outcome (i.e., accession, recruiting loss, or failure to qualify). These outcomes are depicted in Figure 3. Each stage of the process involves a decision, either on behalf of the individual or the Army (e.g., medical or Armed Forces Qualifying Test [AFQT] rejections), of whether to continue the recruitment process.

Accordingly, each decision point in Figure 3 defines an outcome group(s) and involves a population with differing demographic characteristics. For example, Berryman et al. (1983) examined the demographic composition of seven of these outcome groups using information on the 1977 cohort of applicants. When comparing the multivariate means of several demographic variables (age, AFQT score, educational attainment, etc.), discriminant analyses indicated that AFQT failures and individuals who were fully qualified but did not enlist (QNEs) were the most dissimilar to other outcome groups. AFQT failures were much more likely to be high school dropouts, poorer, younger, and from a minority group. QNEs, in contrast, were more likely to be older, have dependents, have had some college, and live in a metropolitan area. They also noted that partially qualified losses (i.e., those who qualify on the AFQT exam, but did not continue, or 'PQ's) are quite similar to direct accessions, but

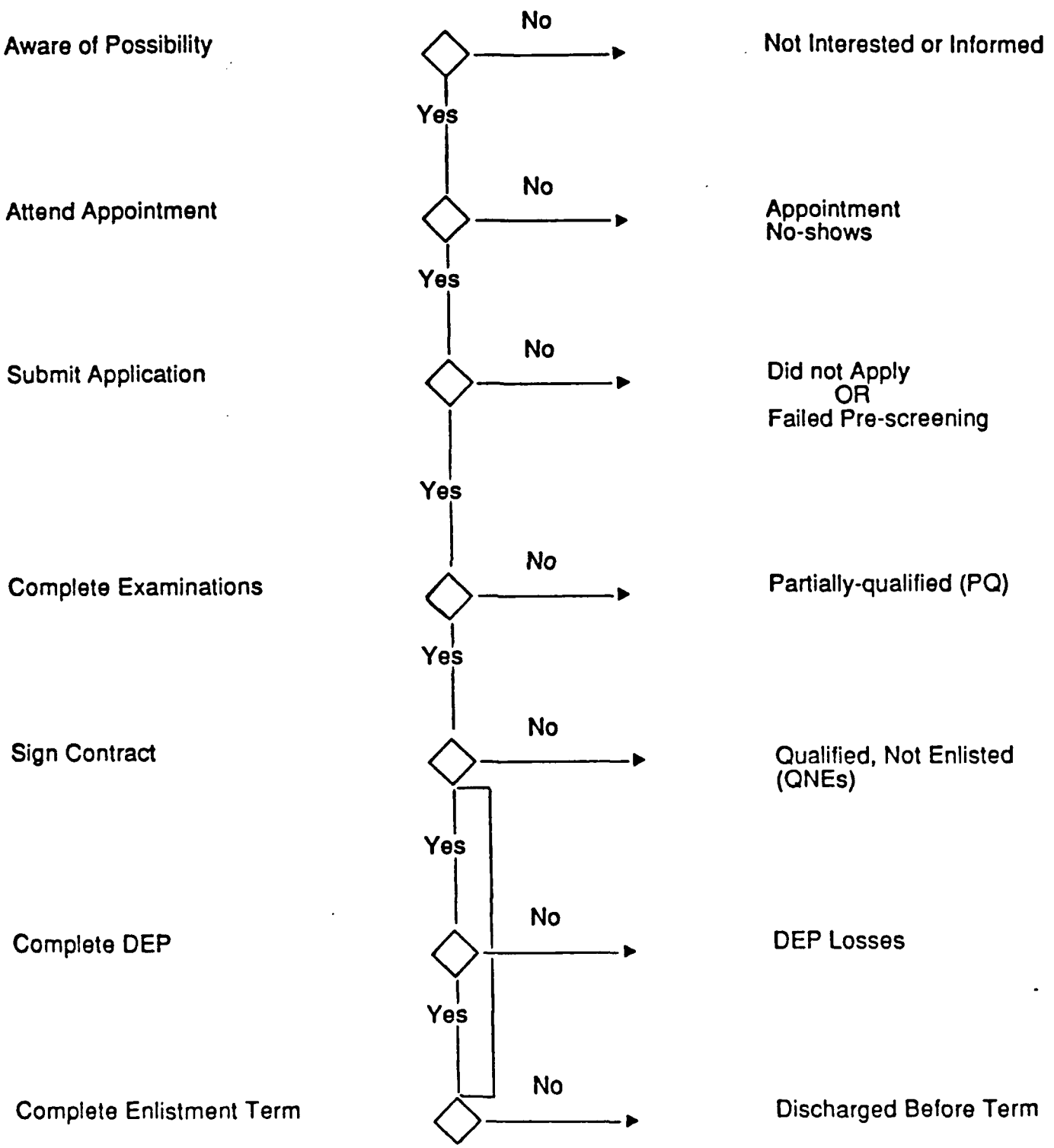

Figure 3. Enlistment decision process.

differ in terms of better civilian employment and educational opportunities. With respect to these last two groups, these analyses are especially interesting for the clues they provide about what kinds of incentives or changes in recruiting practices may be necessary to attract additional enlistees from these losses.

In addition to cross-sectional demographic differences, longitudinal differences also exist across the stages of the enlistment process. For example, Orvis (1982) found that only 50% of a sample of eligible youth who expressed a positive intention to enlist, had in fact enlisted about five years later. More dramatically, Hosek and Peterson (1990) report that about 2/3 of the women recruits in the two years following a 1980 survey had expressed a negative propensity to enlist.

From the research point of view, these results provide a strong rationale for using great care in selecting samples to study, in formulating dependent variables, and in interpreting data. For example, assessments of advertising effectiveness would ideally be made using information collected from the most relevant group--the eligible population (ie., 17-24 year-olds). Advertising probably exerts its influence most strongly by increasing the number of eligible youth who begin the recruiting process. That is, advertising alerts eligible youth to Army opportunities, thereby increasing the likelihood that they will contact the Army, or when contacted, will respond by attending an appointment with a recruiter. Hence, sampling eligible youth or first contacts would be the more relevant populations.

When this is not feasible, due consideration should be given to systematic differences in composition between the sample used and the population to which inferences are made. Errors in data interpretation and decision-making due to non-representative sampling can be reduced when sample biases can be specified. This can best be accomplished by regularly sampling these outcome groups to identify demographic and other characteristics which may systematically affect the inferences which need to be made. Descriptive information about the populations at each point of the recruiting process (e.g., Berryman et al, 1983) is essential for evaluating the size and direction of biases in the data introduced by selection biases in the samples.

Recruiting Activities (Independent Variables)

During the 1980s, the Department of Defense sponsored studies on three major interventions used to increase the quality and quantity of Army enlistments. These studies were conducted by researchers at the Rand Corporation. They are: Recruiting Effects of Army Advertising (Dertouzos, Polich, Barmezai, & Chesnutt, 1989); Enlistment Effects of Military Educational Benefits (Polich et al., 1982); and The Enlistment Bonus Experiment (Polich et al., 1986). In addition to the effects of advertising, scholarships, and bonuses, these studies measure and

discuss the effects of recruiter effort, a fourth major category of interventions which impacts the level of Army enlistments. The objectives and findings of these studies are summarized below.

Advertising

The Army spends about $40 to $45 million dollars annually for recruiting advertising in major media (Dertouzos et al., 1989). Additionally, the Department of Defense spends about $15 to $20 million on joint service recruitment advertising. At the national media level, these funds are utilized on television (69%), network radio (18%), and magazines (13%). About 10 to 16% of overall advertising resources are allocated for local advertising. These funds are distributed to local radio (57%), daily newspapers (27%), and high school and weekly newspapers (8% each).

While the advertising purpose is to increase enlistments, the strategy differs between national and local media. The focus of national media advertising is to enhance the organizational image and to describe the general character of Army training and work. Local media efforts, in comparison, tend to provide more detail, such as current job opportunities, enlistment options, and the telephone number of the local recruiter.

The effects of advertising are significant and immediate. A 100% increase in television advertising was estimated to increase enlistments by 2% in that month (Dertouzos et al., 1989). Furthermore, the effects extend for as long as six months, declining each month about 42%. Among types of media, national TV and magazines were found to produce the largest effects. However, when costs were factored in, this ordering changed. The most cost effective media for increasing high quality recruits are, in order: weekly newspapers, magazines, daily newspapers, network radio, and national TV, respectively.

These results were based upon econometric analyses of monthly data, collected at the MEPS level, for a three year period. The study controlled for the effects of the number of recruiters, their recruiting goals, local economic conditions, and levels of other recruiting sources. This study extended previous research by differentiating between media types and by including the effects of local advertising. However, the data did not permit an assessment of other important issues, including: whether enlistment increases were drawn from the civilian sector or other services; what long-term effects there might be on the public, on military morale, and on reenlistment behaviors.

Educational Benefits

Educational benefits for military personnel represent an important enlistment incentive. Unlike previous "GI Bills",

programs for educational assistance examined here are targeted to 'high quality' (i.e., high school graduates with AFQT scores at or above the 50th percentile) individuals in critical skills. In 1981, an experiment was conducted to investigate the effects of four alternative educational assistance plans upon enlistment. These four plans, formulated by Congress and DoD, included:

The experimental control. The basic Veterans Educational Assistance Program (VEAP) provided two-for-one matching funds for contributions made by service personnel, up to a combined maximum of $8100. The Army provided an additional $6000 ('kicker') for eligible recruits in selected jobs.

Noncontributory VEAP. This was the same program as the control, with the exception that no contribution was required of the participant.

Tuition/stipend. This program increased the benefits, up to $15,600 indexed for inflation, and was available to eligible recruits in all services. Under this plan, all services provided the same program (e.g., there were no kickers for the Army).

Ultra VEAP. This program expanded Army kickers to $12,000 for eligible recruits (i.e., 'high-quality' recruits).

These plans were offered by recruiting stations in balanced sets of geographical areas for the period from December 1980 to September 1981. The experimental design utilized regression analyses with controls for unemployment, civilian wage rates, program advertising, number of recruiters, and trends over time.

The results indicated that educational assistance programs could produce substantial increases in enlistments (Polich et al., 1982). The Ultra VEAP program produced a 9% increase in Army enlistments. The Tuition/Stipend plan increased Navy and Air Force enlistments by 5 to 8%, but decreased Army enlistments by 6%. The Noncontributory plan had nonsignificant effects.

Bonuses

Cash bonuses, paid to high quality new recruits in targeted jobs, represent a flexible and important enlistment incentive. Congress, in the early 1980s, directed a test of expanded bonus options as a means of attracting additional, high quality youth into the Army. The options were as follows:

Experimental control. A $5000 bonus for a four year enlistment was available at 70% of the recruiting stations.

Plan 1. An $8000 bonus for a four year enlistment was available at 15% of the recruiting stations.

Plan 2. An $8000 bonus for a four year enlistment or a $4000 bonus for a three year enlistment was available at 15% of the recruiting stations.

The test was conducted from July 1982 through June 1984. MEPS areas were assigned to each plan in the percentages indicated. Assignments were randomized under constraints of balancing the test sites in terms of geographical distribution, previous enlistment rates, civilian economic conditions, and Army recruiting goals. Test data were collected monthly for a one year base period and during the two year test period. Data were collected on selected control variables, including: national and local advertising expenditures, unemployment rate, civilian wage rate, number of recruiters, and recruiter quotas for high and low quality recruits.

The data were examined for three possible effects: (1) market expansion (i.e., increase in total enlistments); (2) skill channeling (shifts of recruits to targeted jobs); and (3) term of enlistment (changes in choices between 2, 3, and 4 year options). The results showed a significant market expansion effect (Polich et al., 1986). Plan 1 ($8,000 bonus) increased overall enlistments 4.1% and plan 2 ($8,000 bonus for 4 years, $4,000 for 3) increased enlistments by 5%.

The skill channeling effect of the bonus options was also substantial (Polich et al., 1986). Plan 1 produced a 31.7% increase in eligible skills, while plan 2 produced a 41.5% increase. The bonus plans also produced significant shifts in the term of enlistment contracts. Plan 1 increased 4 year enlistments by 15.3% but with a 28.5% reduction in 3 year enlistments. Plan 2 increased 3 year enlistments by 87% with no change in 4 year enlistments. The combined effects of market expansion and shift in enlistment terms generated increases of 6% and 8% in obligated man-years of military service for plans 1 and 2, respectively.

Recruiter Effects

A fourth approach to affecting recruiting outcomes involves the allocation of recruiter resources--the number of recruiters, and their level and direction of effort. Although no large-scale experiments were directed to this important component of recruiting effectiveness, several studies did include recruiter numbers or effort as control variables. Estimates of recruiter effects in these studies confirm the importance of recruiters and their activities for achieving recruiting success.

The relative number of recruiters working plays a central role in meeting service goals of quality and quantity of recruits. However, the marginal utility of increasing the number of recruiters versus other alternatives for increasing enlistment supply is difficult to assess. Comparing coefficients of these variables across studies is problematic because differences in

levels of data aggregation, methods used, variables included, etc., can strongly affect parameter estimations.

However, the rank order of recruiter levels compared to other variables affecting the supply of enlistments consistently shows it to be one of the more important factors in recruitment. In two studies (Cotterman, 1986; Polich et al., Press, 1986), the coefficient for recruiter levels ranked second to unemployment rate for its effect upon enlistment supply, and in one study (Dertouzos et al., 1989), it was ranked first.

Although less important than the number of recruiters, the direction and level of recruiter effort also significantly influence the quality and quantity of recruits. The recruitment of high versus low quality recruits often requires different recruiting activities with differing levels of effort associated with them. Recruiters typically must spend more time to attract high quality prospects. This time is spent talking with prospects; talking with their parents, coaches, and high school guidance counselors; attending science fairs and career days, etc. In contrast, recruiters can more easily increase the number of low quality recruits with the less time consuming activity of enlisting those who walk-in at the recruiting station or by obtaining youth counselling referrals (Polich et al., 1986).

Direct assessment of the direction and level of recruiters effort is not feasible. However, Polich et al. (1986) estimated these effects by utilizing information about recruiters' quotas for high and low quality recruits and their performance relative to these quotas. Their results appeared to confirm the substantial additional effort required to enlist high quality recruits. Their data also indicated that increases in enlistment supply can produce a decline in recruiter effort, if quotas or other measures are not taken to ensure that a high level of effort is maintained.

Market Segmentation (Moderating Variables)

The efficient utilization of recruiting resources depends upon targeting these resources to appropriate market segments. Market segments vary considerably in enlistment propensities and in their receptivity to differing types of media, advertising content, and enlistment incentives. Additionally, the accuracy of inferences made from survey information depend critically upon how representative samples are of the desired population(s). This requires precise knowledge about the composition and defining characteristics of the relevant population.

From a scientific point of view, this can be viewed as variables which moderate the impact of recruiting interventions (independent variables) on the recruiting outcomes (dependent variables). Identifying and controlling for the effects of these variables is essential to estimating precisely the effects of the independent variables.

Three types of moderating variables have been studied: psychological, economic, and demographic. We discuss the effects of each these next.

Psychological Variables

Examination of psychological variables holds some promise for providing more precise explanations of enlistment decisions. While demographic variables tend to describe characteristics of groups which distinguish differential probabilities for enlistment, psychological variables provide information about individuals. Most enlistment studies analyze data at an aggregate level of analysis and organize market segments based upon group status. To the extent that organizing market segments based upon individuals' characteristics improves our understanding of enlistment decisions, targeting recruitment resources to market segments based upon psychological variables could improve recruiting effectiveness.

Enlistment motivation pattern. Recruits' motivation to enlist includes both psychological as well as economic reasons (Elig, Johnson, Gade, & Hertzbach, 1984; Pliske, Elig, & Johnson, 1986). Using a large sample survey of 1982 and 1983 recruits, enlistment motivation was assessed using two different question formats--a forced-choice format (10 response options) and a multinomial approach (15 to 28 options, depending upon survey version). Consistent with previous results, the top reasons for enlisting across three cohorts of recruits (1979, 1982, 1983) were, in order: chance to better myself, get trained in a skill, money for college education, to serve my country, and to escape unemployment. Given the sharp increases in unemployment in the early 1980s, it is not surprising that significant increases were found for escaping unemployment (from 4% in 1979 to 10% in 1982) and for obtaining money for a college education (from 7% in 1979 to 15% in 1982).

To explore the structure of enlistment motivations, principal components analyses were conducted, yielding six distinct motivational factors underlying the 28 multinomial enlistment responses. These were: self improvement, economic advancement, military service, time out (i.e., to decide future plans or to escape personal problems), travel, and education money. The usefulness of a more clear understanding of the psychological determinants of enlistment is illustrated by one application of these findings. When examining term of enlistment, recruits who enlisted for four years were primarily motivated by military service, compared to motivations of travel and obtaining money for education for recruits enlisting for two year terms.

AFQT. Applicants are classified into one of six categories based upon their scores on the Armed Forces Qualifying Test. These categories are as follows (Berryman et al., 1983):

Category I	93 - 99th percentile
Category II	65 - 92nd percentile
Category IIIA	50 - 64th percentile
Category IIIB	31 - 49th percentile
Category IV	10 - 30th percentile
Category V	1 - 9th percentile

Categories I-IIIA constitute the priority, 'high quality', groups for recruiting. Applicants from Categories IIIB and IV are accepted, but not applicants from Category V. As previously mentioned, AFQT failures were much more likely to be high school dropouts, poorer, younger, and from a minority group.

In general, the higher the AFQT score, the less likely it is that an individual will enlist. This pattern is evident across PQ losses, medical failures, and QNE losses (Berryman et al., 1983). However, DEP losses show no relation to AFQT scores. A major exception to this trend is for graduates who expect more education--their enlistment probability increases with AFQT score.

Educational expectations. Within the market segments of high school graduate/nongraduate, Hosek, Peterson, and Eden (1986) found educational expectations to be an important sub-segment which defines enlistment outcomes and the effectiveness of enlistment interventions. Specifically, among graduates who expect more education, enlistment probability increases with AFQT score. This is in sharp contrast to graduates who do not expect more education. Their enlistment probability decreases with higher AFQT scores, as do seniors, regardless of educational expectations.

Economic Variables

Unemployment rate. Unemployment rates play a significant role in determining the level and quality of enlistment supply. The effects of unemployment levels have been estimated in studies of various enlistment interventions (i.e., bonuses, educational benefits), where unemployment is included as a covariate in systems of linear equations developed to evaluate the impact of these interventions. Estimates of the effects of unemployment on enlistment supply vary considerably, but in all cases are substantial. In terms of relative magnitude, it is comparable to the substantial effects of enlistment bonuses and educational benefits and is much larger than effects of civilian pay rates, recruiter effort (i.e., assigned goals), number of recruiters, and levels of national and local advertising (Cotterman, 1986; Polich et al., 1986).

The inconsistency in estimation of the size of the unemployment effect is apparently a result of the differing approaches to its measurement and to the quantitative methodology used for modeling enlistment supply. Unemployment has been operationalized as the unemployment rate and as the deviation

from trends in business cycles. Further, modeling approaches have differed with respect to whether observations are considered statistically independent or dependent [for a discussion of these issues, see Cotterman (1986)].

Wages. Increases in civilian pay, compared to military pay, produce declines in enlistments. This responsiveness to wage differentials is characterized in econometric modeling by an elasticity, or the "effect of a 1 percent increase in the hourly wage on the percentage change in the enlistment probability" (p. 17, Hosek et al., 1986). Elasticity values vary, depending upon the sample and methods used. However, estimates of wage differential elasticities are more consistent than those for unemployment, although the size of the effect is much less.

Importantly, wage responsiveness also varies according to market segment. Analyses by Hosek et al. (1986) indicate that enlistment probabilities for seniors who do not expect further education are very sensitive to prevailing wage rates. In their study, the elasticity for this group was -3.3 (i.e., a 1% increase in hourly wage produces a 3.3% drop in enlistments) compared to -1.1 for graduates who expect more education, -.65 for graduates who do not, and -.59 for seniors who do.

These analyses demonstrate the usefulness of market segmentation and the importance of using more than one variable to define the segment. Without these analyses, the sensitivity to wage rates of high school seniors not expecting additional education would have been masked in the overall average elasticity across groups of -1.45. The practical application of these results is in targeting recruiter activities and advertising resources to the seniors not expecting future education, when local conditions show that civilian wages are comparatively less favorable with respect to military wages.

Demographic Variables

Gender. Women represent a substantial, and increasing, segment of active duty military personnel. Their participation has grown from 1% in 1970 to almost 11% currently (Hosek & Peterson, 1990). The range of jobs available to them has also increased, but combat and combat-related positions remain excluded. Because women represent a large potential source of recruits, research was conducted to assess the determinants of enlistment decisions for women. The determinants examined include career (earnings and employment opportunities), personal (marriage), and education variables (academic ability, the ability to finance further education, education plans). The results indicated ". . that for most variables the coefficients are statistically equivalent for male and female seniors and for male and female graduates" (p. vii, Hosek & Peterson, 1990). Some differences were identified. These included a smaller effect for labor force variables and a lower enlistment probability for women who intend to marry within five years (vs.

no effect for men who intend to marry). These results suggest that current advertising, incentives, and recruiting practices perform about as well for women as for men. However, the researchers recommended additional work on the responsiveness of women to initiatives targeted specifically to them.

Race. In terms of applicants and accessions, blacks have generally been overrepresented and whites and Hispanics underrepresented with respect to the youth population. In 1977, blacks comprised 12% of the population of 18 to 24 year olds, 23% of the applicants, and 21% of the accessions. Eighty percent of the youths in the 1977 population were white and 76% of the accessions were white. Hispanics comprised 6% of the youth population and 2% of the accessions (Berryman et al., 1983).

Blacks were also overrepresented in terms of AFQT failures, failing at triple the rate of whites. This could result from differences in educational attainment and from the interaction of educational attainment with AFQT standards [in 1977, AFQT standards were higher for high school dropouts than for graduates (Berryman et al., 1983)].

Age. Youth, aged 16 to 18, comprised 60% of the 1977 accessions. Nineteen to twenty-one year olds accounted for 29%, 22-24 for 7%, 25-29 for 3%, and 30 to 39 year olds for .4% (Berryman et al., 1983). Furthermore, age showed consistent trends of increasing losses with increasing age for PQ and QNE losses and for medical failures. There were no age-related trends for DEP losses, but AFQT failures declined with increased age, except for the 16-18 year old group.

Marital and dependency status. Over 90% of the 1977 accessions were single. For those who were married, PQ, QNE, and medical failure losses were positively associated with the number of dependents (Berryman et al., 1983).

Educational status. Educational status is one major distinguishing variable that defines two important market segments--the high school senior vs. the high school graduate (Hosek et al., 1986; Hosek & Peterson, 1990). Seniors' enlistment probabilities are more affected by education-related variables such as ability to finance further education, and parental and personal educational expectations. In contrast, graduates' enlistment probabilities depend more upon work-related variables. Enlistment probabilities increase when unemployment increases and when civilian pay, work experience and job tenure decrease. With respect to recruiting losses, high school nongraduates had triple the AFQT failure rate and even one year of college substantially increased PQ and QNE loss rates (Berryman et al., 1983).

Ability to finance education. Family income is negatively related to enlistment probability for high school seniors expecting more education (Hosek et al., 1986). Surprisingly,

family income shows no relationship to enlistment probability for graduates, even for those who do expect to further their education.

Summary

We organized the review of recruitment studies according to recruiting outcomes (dependent variables), recruiting activities (independent variables), and market segmentation (moderating variables). This organization is useful to survey researchers by identifying important variables that must be estimated and controlled when interpreting survey results and by identifying variables that define the composition of survey populations. With an understanding of this recruitment process in mind, we next present a general model of survey sampling that can be applied to different points in the recruitment sequence.

Sample Representativeness and Seasonality Effects: Data Analyses and Discussion

In this section, we present the results of data analyses conducted to determine the representativeness of seasonal samples of Army recruits in the New Recruit Survey (NRS). These analyses extend previous results (Hay, 1990) that examined the representativeness of samples obtained from existing procedures.

We also examined the feasibility of using weighting strategies to represent an entire year of accessions from data obtained during three months of the year. Our goal was to determine whether full-year NRS results can be reliably estimated from single-trimester data. Such estimation is possible in either of two cases: First, if there is no variation in survey responses across trimesters then one trimester is representative of the full year and surveying need be done only during one trimester. Second, even when variation across trimesters exists, full-year NRS responses can be estimated if the variation follows a predictable pattern. Such an extrapolation, of course, requires that social, economic and political conditions during the new survey be unchanged from those under which the extrapolation equations were derived.

These analyses were conducted using data provided by the Army Research Institute (ARI) and included survey responses of non-prior service (NPS) recruits to the New Recruit Surveys conducted during 1987, 1988, and the first two trimesters of 1989.

Our analyses indicate that full-year responses for some NRS questions can be predicted from single-trimester data, others need not be predicted, and still others cannot be predicted at all. Some of the most important questions could not be predicted from single-trimester data; those items should be surveyed at least every trimester. These results are discussed in detail

below, following a brief description of previous research and a presentation of the research methodology.

Review of Previous Research

Two existing reports relate directly to this project: recent work by Hay (1990) on seasonality effects in NRS responses, and a hierarchical log-linear analysis of NRS data (Barnes, Crawford and Minadeo, 1990).

Hay (1990) analyzed two years of NRS data (1987-1988) "to determine if there are substantial seasonal variations in characteristics of accessions". She found that AFQT category, age at contract, gender, geographic region, enlistment term, length of time in DEP, first contact with an Army recruiter, and circumstances of that first contact "appear to have substantial seasonal effects". Based on her work we see that these NRS items must be surveyed during the full year unless predictable seasonal patterns can be identified. It is therefore worthwhile asking whether statistical equations exist that could explain those seasonal effects.

Barnes et al. (1990) investigated whether "all three trimesters of the New Recruit Survey must be sampled to insure accuracy of the survey results". Their hierarchical log-linear analyses investigated whether categorical items representing five major areas of concern (first contact, college fund, reason for enlistment, school status and work status) varied across trimester, gender and/or year of survey. Barnes et al. concluded that "all three trimesters are needed in the survey" because statistically significant relationships were identified in their study.

Apparently Barnes et al. were not aware that the existence of statistically significant relationships implies two conclusions, their own and one other. First, it is true that single-trimester data are not representative of full-year data, but, second, three-trimester data are related to single-trimester data through the statistically significant log-linear equations that Barnes et al. computed (but did not report). That second conclusion points toward the possibility of predicting full-year NRS responses from single-trimester data.

Earlier in this report we described the recruitment process and noted that, in order to address certain questions (such as the importance of enlistment incentives to those who choose not to enlist), surveys of prospects must be conducted prior to accession. We noted that responses to certain survey questions (such as percent planning to use the new GI Bill) are dependent upon the efforts of recruiters, which are themselves dependent upon administrative and legislative direction. Results of data analyses (discussed below) reinforce this observation.

Since survey responses for some items depend on legislative and/or administrative efforts, any estimation of full-year NRS results from single-trimester data must consider whether the survey is being conducted under conditions identical to those under which the estimation equations took place. Considering recent social and political changes (economic recession; war in the Persian gulf), it is clear that some past prediction equations will not be usable in the future. Although relationships have existed in the past, new ones will need to be detected and quantified for future use.

In summary, Hay (1990) established that systematic patterns exist across trimester for a number of NRS questions. Barnes et al. (1990) showed that statistically significant relationships (and therefore predictable patterns) also exist for certain NRS items. Estimation equations can therefore be created to use single-trimester data in place of full-year data for some NRS items if and only if survey conditions remain constant from trimester to trimester and from year to year. However, political, social and economic conditions have not remained constant and so prediction equations are somewhat problematic. Results to be discussed below illustrate the degree to which survey results may change trimester by trimester in contradiction to historical patterns, as well as reporting data that may be estimated. We have presented estimation equations for those variables that appear to be predictable at this time.

Methodology

Data analysis started on this project after three magnetic tapes containing NRS data (as SAS files) were received from ARI during July, 1990. The tapes were converted from an IBM-specific format to the VAX-compatible SAS Data Transfer Format at the University of Minnesota St. Paul Computing Center, after which new data tapes could be written to transport the SAS data sets to microcomputer. Our original plan was to use SAS/PC version 6.03 for data analysis, but a bug in SAS required that we upgrade to version 6.04 before being able to transfer the data sets. We were able to work around a second bug in the SAS data transfer routines. Analyses were primarily performed using SAS/PC (version 6.04) starting during August, 1990. Microcomputers were used for data analysis to reduce computing expenses.

The first step in data analysis was to create a subset of variables for further analyses. More variables were selected for this subset than were expected to be analyzed. Selected variables included: most important reasons to enlist; first contact with recruiter; circumstances of first contact; term of enlistment; effect of loss of incentives; demographic variables; and contract variables.

The analysis data set included data for over 17,000 non-prior service recruits, as follows:

	Summer	Fall	Winter	Total
1987	3,029	2,420	1,556	7,005
1988	1,859	2,285	1,719	5,863
1989	1,960	2,215	--	4,175
Total				17,043

After creating the analysis data set, the 1987-88 results obtained by Hay (1990) were replicated and extended by including the two 1989 trimesters. Those results are discussed and plotted in the next section of this report. We also considered several related questions that Hay did not address. One question was whether the three-trimester data could be separated into monthly data, a desirable outcome since monthly data should be more able to detect time-series trends than is trimester data. The usability of monthly data is problematic because monthly differences exist within each trimester resulting from the method of surveying. Those differences were caused by surveying different reception battalions during different months.

A second question we considered is whether the number of recruits could be analyzed in addition to the percent responding to each item in each way. It was not possible to analyze raw counts in this manner because of the varying number of surveys completed during each trimester and the unknown total number of recruits passing through each reception battalion each trimester.

Results

This project is concerned with determining whether full-year NRS results can be reliably estimated from single-trimester survey results. Hay (1990) and Barnes et al. (1990) established that differences across trimester do exist: single-trimester data are not representative of full-year responses. We have also reached that conclusion. It is still be possible (theoretically) to identify statistical relations to allow prediction of full-year results from single-trimester data when across-trimester differences are consistent across years.

We have found that the predictability of NRS responses depends upon the individual item, and have grouped NRS items into three classes:

Items which cannot be predicted at all;
Items for which prediction is possible; and
Items for which seasonality effects are unimportant.

The items which cannot be predicted are those which are sensitive to changes in administrative and/or legislative direction (such as plans to use the G.I. Bill), even though they may have demonstrated seasonality patterns in the past. Items for which prediction appears possible are those which show consistent

patterns across all eight trimesters analyzed, and include questions such as the circumstances of first contact with Army recruiter. Items for which seasonality effects are unimportant include questions such as loss of recruitment incentives, which may show seasonal variation that is highly statistically significant, but whose variation is so small that the rank-order of importance of items does not change.

The discussion that follows focuses on these three types of item predictability and analyzes the percent of recruits selecting different responses to each item. We have generally compared or contrasted our results to those of Hay (1990) since hers is the most recent and the most directly applicable research on this topic. It could have been surmised from Hay's work that all items showing seasonal variation could be predicted from single-trimester data since the seasonal patterns were consistent across the two years analyzed (1987-88). When different patterns appeared in the 1989 data, we realized that some of the items were not predictable.

Items Which Cannot Be Predicted

Non-predictable items do not vary randomly across trimesters. Random variation would imply that one trimester would be representative of a full year. Instead, these items follow patterns, but the patterns can be disrupted by social, economic or political changes. They can also be changed by legislative and/or administrative efforts.

Actually, the full-year responses to these items can be predicted from single-trimester data if those social, economic, political, legislative and/or administrative influences are included in the prediction model. Creating a model of such a comprehensive relationship is far beyond the limits of the data available for this study.

Percent in each AFQT category. Figure 4 shows that the responses to this item vary widely from year to year. There is a pattern showing a small percent of recruits accessing during spring and summer who are classified as AFQT-I, and a larger percentage in the winter. But that larger percentage is so variant from year to year that a prediction would not be meaningful. The percent of AFQT-I recruits varies by a factor of two from year to year, making prediction errors large. Those errors are magnified when it is noted that the percent of AFQT-Iin spring and summer (the data upon which a prediction would be based) also varies by more than a factor of two.

Mean enlistment term. Hay (1990) identified a pattern in mean enlistment term, with recruits accessing in spring having the shortest term and those in winter the longest. Mean enlistment term also increased from 1987 to 1988. However, that pattern was reversed in 1989: Summer accessions had shorter mean enlistment terms than spring accessions, and overall terms

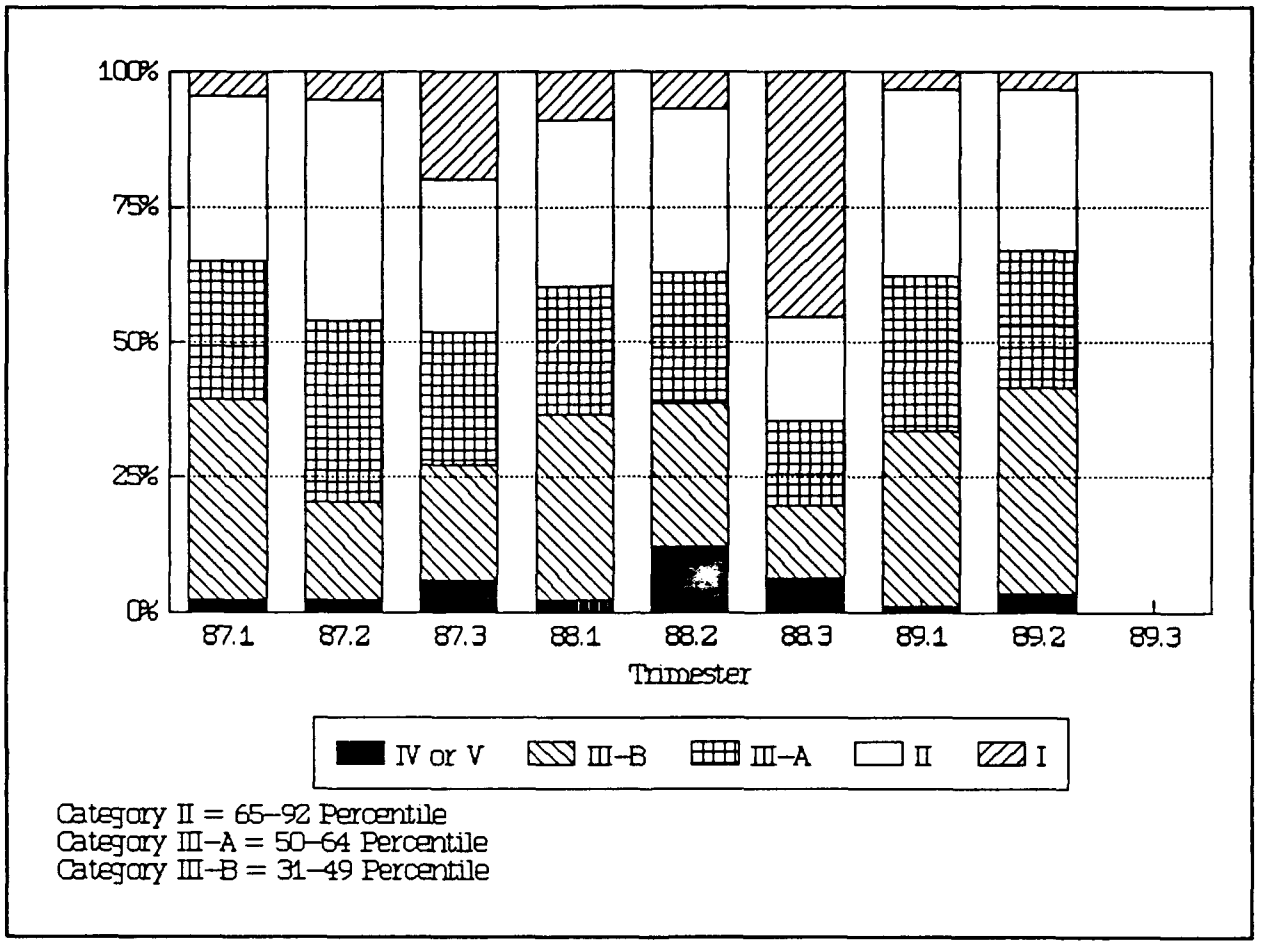

Figure 4. Percent in each AFQT category for all NPS recruits combined.

started to decrease (See Figure 5). The changes in this variable illustrate the unpredictability that is (presumably) caused by administrative and/or legislative action.

Percent planning to use GI Bill. We see patterns across three trimesters for 1987-88 data for this variable, but those patterns are contradicted in 1989 (See Figure 6). Although initial results would suggest full-year responses to this item could be estimated from single-trimester data, we now see that this is not possible, presumably the result of changed social values of youth or changed recruiting efforts by the Army. The changes across trimester are too large to consider a single trimester representative of the full year, and there is no consistent pattern of responses to allow creation of an estimation equation.

Recruit educational aspirations. This item appears to be somewhat predictable at first glance, but less so when examined in detail (Figure 7). Although the percentage of recruits planning to complete a GED or a bachelor's degree is fairly constant across time, the percentages of recruits aspiring to complete other degrees follow unpredictable patterns.

Items considered together. When creating a statistical model of any social process, it is necessary to consider the interactions and relationships between items as well as the items themselves. There is often additional information contained within item relationships that illuminate the model. When we consider AFQT category, plans to use the GI Bill, and recruit educational aspirations together, we see a contradiction. The huge percentage of AFQT-I recruits in winter 1988 should have had different (more ambitious) educational aspirations and/or plans to use the GI Bill than was seen in other trimesters. In fact, no such relationship was seen.

Educational aspirations remained nearly unchanged from 1987 to 1988, with a smaller percentage desiring a post-graduate degree in 1988 (the opposite of what should be expected). We can either conclude there is an error in the data set or that these variables just cannot be predicted over these changing conditions. We could find no such error in the data set and in interviews with researchers involved in earlier analyses, we found no reason to suspect data errors. That leaves the conclusion that full-year responses to these items cannot be estimated from single-trimester data. It is possible that these results are the consequence of an unusual data gathering situation, some peculiarity in the sampling method. If that is the case, then even three-trimester data may be inadequate;monthly data might be needed to gain accurate estimates of recruit characteristics and attitudes.

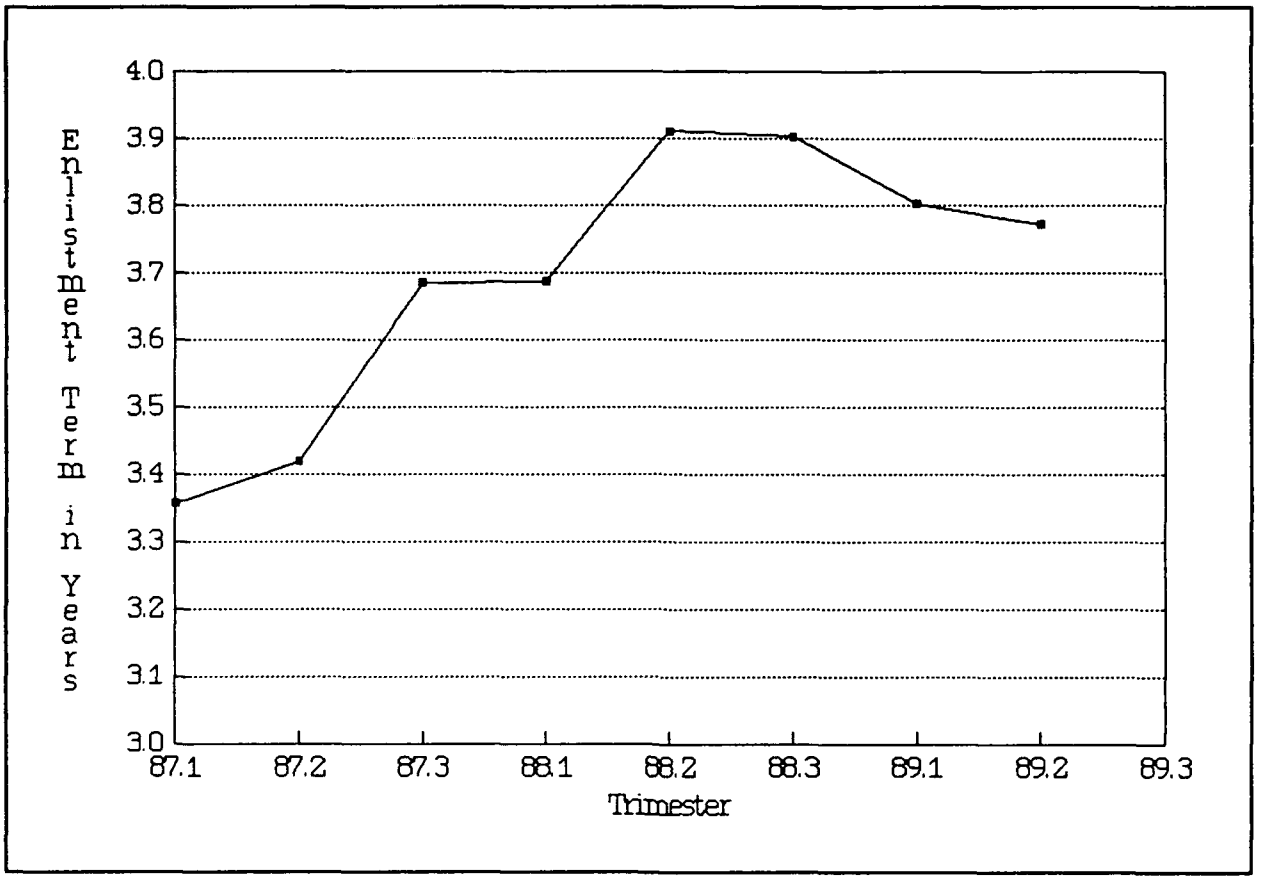

Figure 5. Mean enlistment term, for all NPS recruits combined.

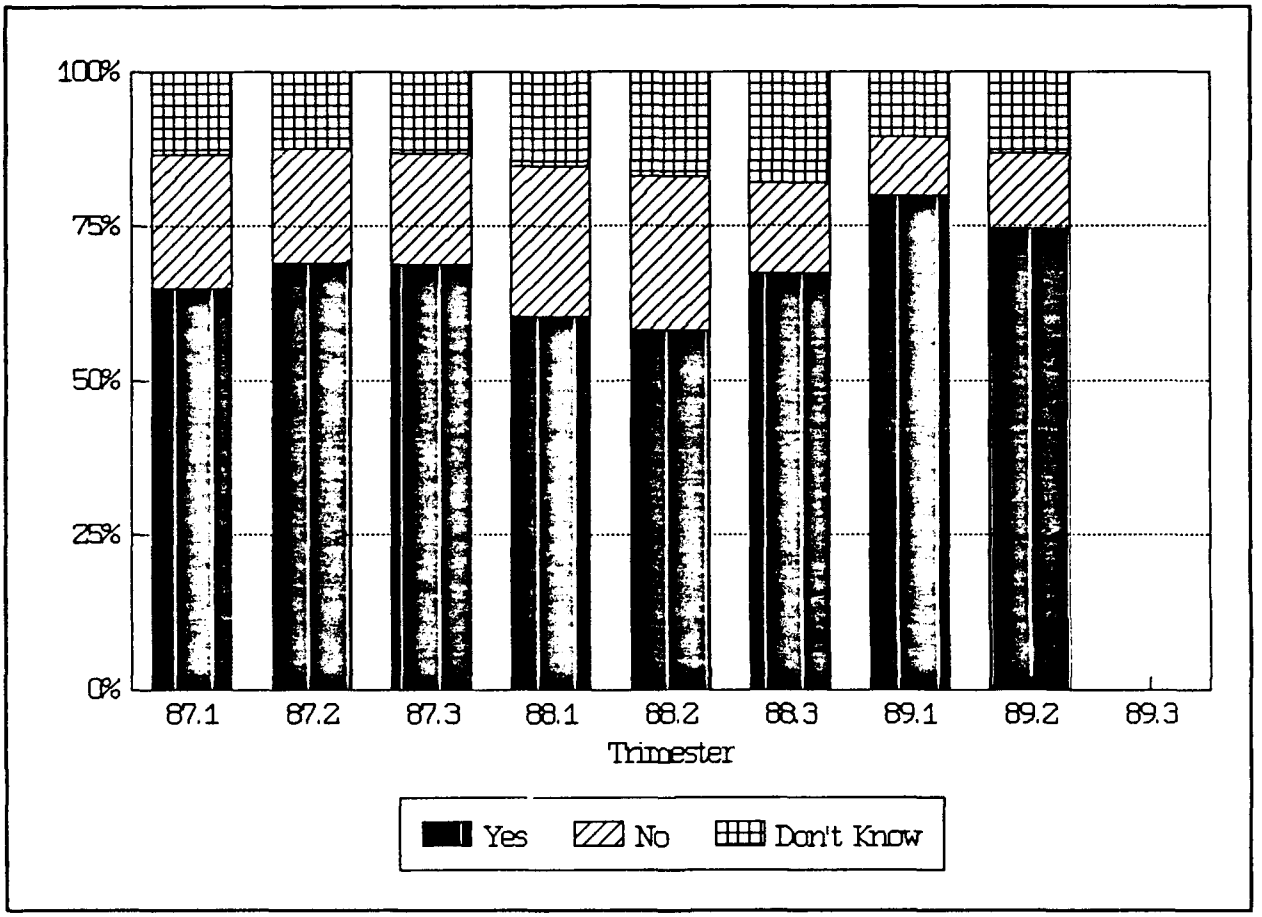

Figure 6. Percent planning to use GI Bill, selecting those who know of the GI Bill and who have not had counseling.

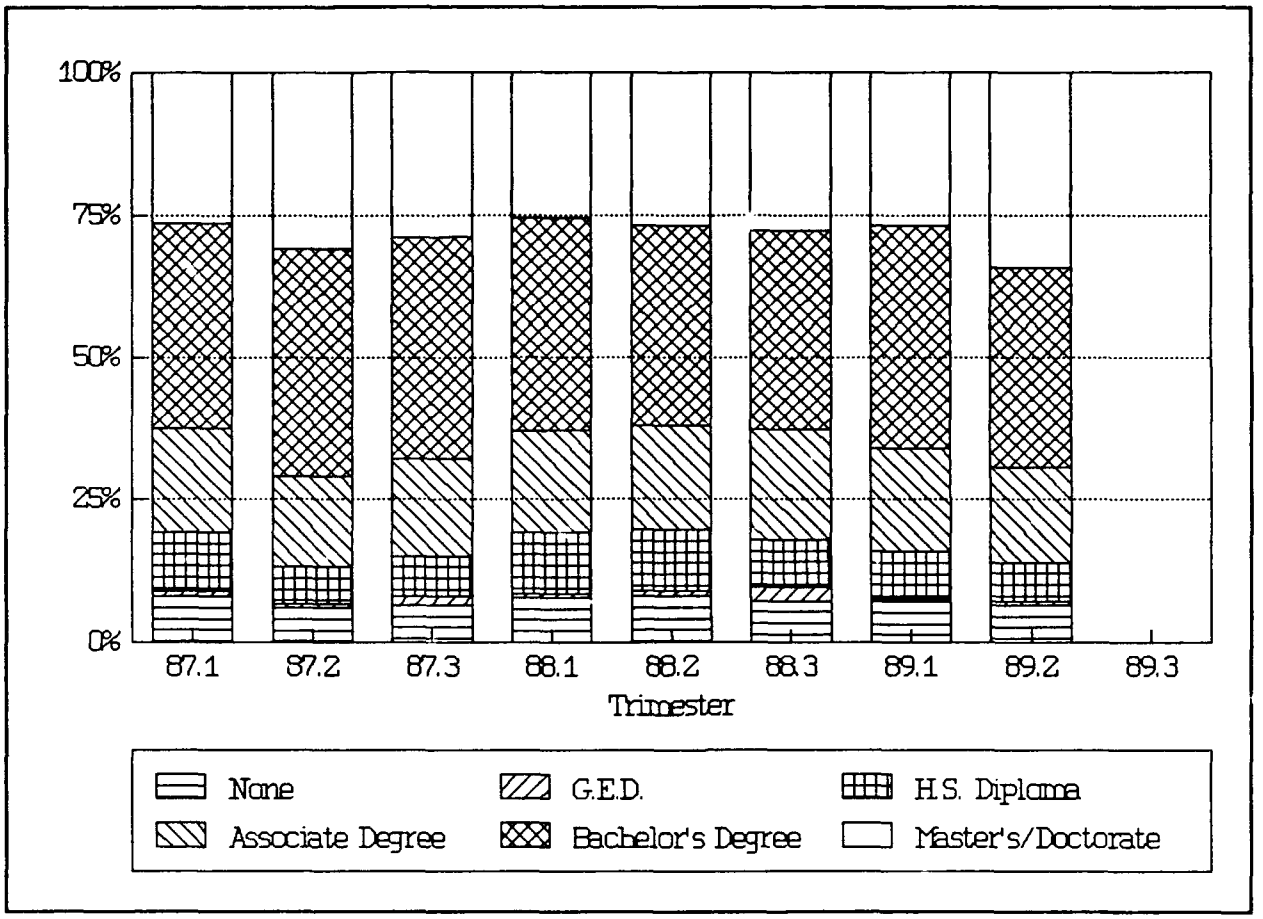

Figure 7. Recruit educational aspirations, for all NPS recruits combined.

Items For Which Prediction May Be Possible

Two types of NRS item are included in this category: certain demographic items and certain enlistment process items. Survey results are graphed in Figures 8 through 15:

Enlistment process items:
- Fig. 8: First contact with Army recruiter
- Fig. 9: Circumstances of first contact
- Fig. 10: Mean age at time of DEP contract
- Fig. 11: Mean number of days in DEP

Demographic items:
- Fig. 12: Gender composition of recruit population
- Fig. 13: Ethnic composition of recruit population
- Fig. 14: Percent from each geographic region
- Fig. 15: Percent from each home town type

The predictions described below were performed as simple regressions: the prediction of full-year responses from summer trimester data. Only the 1987-88 NRS data were used for these predictions because full-year data for 1989 are not yet available. The prediction equations should certainly be estimated again with 1987-89 data if possible. In a few instances, responses were constant and estimates are presented as constant values. In those cases, data from summer and fall 1989 trimesters were also used in the estimation.

It is sometimes preferable not to use simple regressions to analyze percentages. Many of the estimation equations presented here do relate to percentages. The decision was made to use regressions for these analyses for two reasons. First, the predictions are for the "natural" percentage variable and, second, for the percentages being analyzed (not too close to 0% or 100%), regressions will give good answers.

The effect of survey sampling error is largely ignored in these estimates. The equations assume, for instance, that approximately the same number of recruits will be surveyed each trimester in order for the variables to be predicted as accurately as the stated standard errors suggest. If the number of respondents decreases, then the survey sampling error may dominate the error from the regression equation.

All of the following equations predict responses to NRS items for enlistees within single reception battalions. Two methodological reasons led us to structure the predictions in this way. First, we had full-year data only for two year, 1987 and 1988. All prediction equations require multiple data points for meaningful calculation, so it was necessary to break down the overall yearly results into smaller pieces in some way. Second, it is likely that enlistees at different reception battalions will be somewhat similar since reception battalions process different military occupational specialties (MOSs). If that is

the case, then reception battalions are "natural" units of analysis and using them will improve the quality of the prediction.

We could also have used the enlistees' MOS as a "natural" unit of analysis for these predictions, but did not do so because of one practical consideration. When estimating the full-year response to a NRS item for all recruits combined, it is necessary to compute the estimates for each reception battalions separately and then average those estimates. The averages need to be computed as weighted means, with the number of recruits being processed at each reception battalion being the weighting factor. If we use MOS as the unit of analysis, there are far more units that need to be averaged when computing the full-year, total sample estimates. A moderate amount of work is involved in computing those averages when eight reception battalions are involved, but that amount of work becomes inordinate when MOSs are considered as the unit of analysis.

It might be worth comparing the quality of prediction when the equations are based on reception battalions compared to MOSs. The computer programming needed for this comparison are outside of the time constraints of this project. If the Army implements summer-only surveying in the future, however, then that comparison should certainly be performed.

First contact. The first contact variable is quite "well-behaved", and patterns detected by Hay (1990) continued into 1989. The percent of recruits whose first contact was initiated by the recruiter decreases from summer accession to fall to spring, and the opposite pattern exists for enlistee contacts (greatest for winter accessions). Referrals from other services or the Army Reserve/National Guard are nearly constant across time and affect very few recruits. A pattern also exists for those whose first contact was with a friend. While economic, social and political conditions are constant and the number and directives of Army recruiters remain unchanged, full-year responses to this variable can be predicted from a single trimester's data.

Estimation of the percent of full-year responses to each option of the first contact variable is estimated from the summer trimester data by:

First contact through Army Reserve or National Guard:

AR/NG = 1.9

First Contact with a friend meeting the recruiter:

Friend = 8.4 + (0.286 * T_Friend)
Std. Error = 1.0
R2 = 0.365

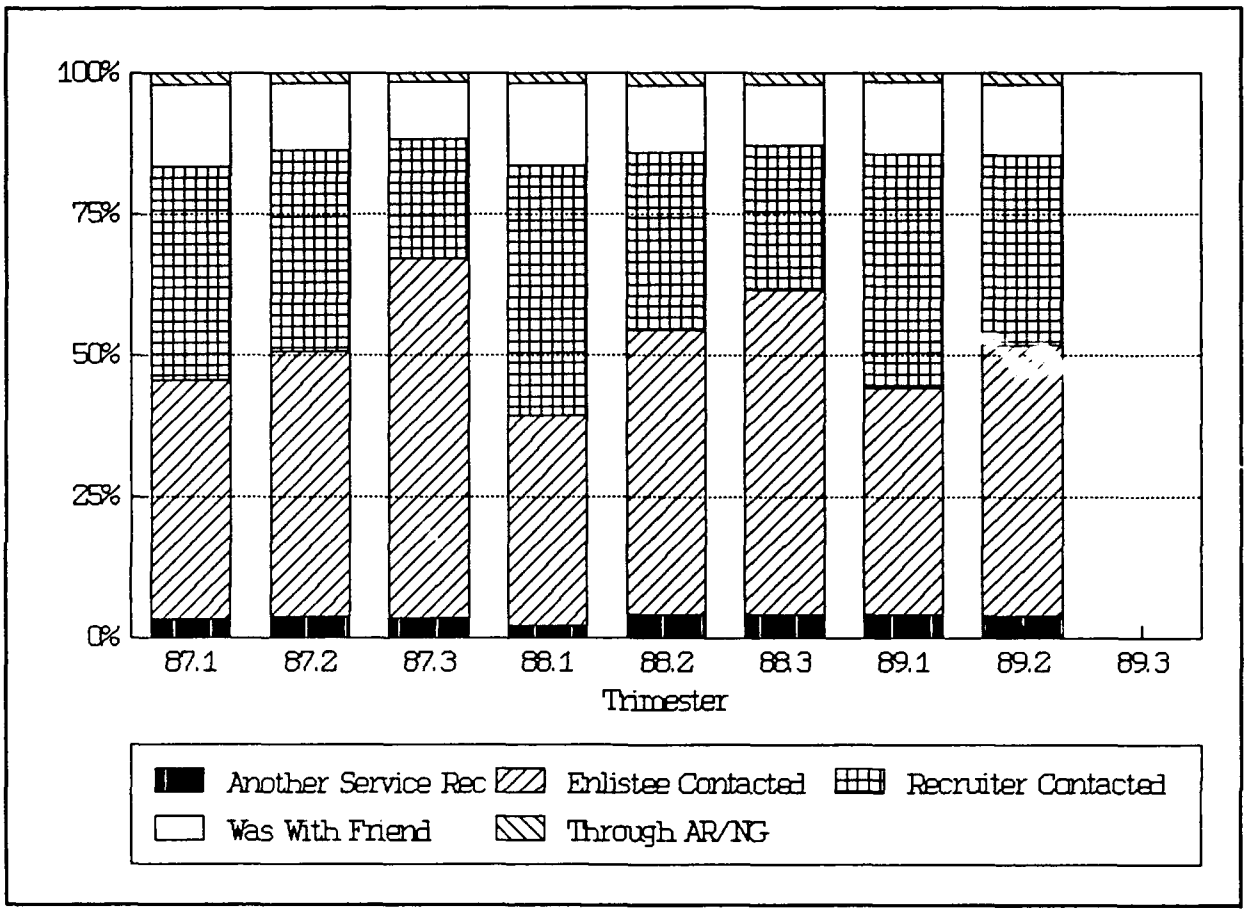

Figure 8. First contact with an Army recruiter, for all NPS recruits combined.

First Contact initiated by a recruiter:
Recr = 14.5 + (0.474 * T_Recr)
Std. Error = 3.8
R2 = 0.386

First contact initiated by the enlistee:
Enlistee = 27.7 + (0.511 * T_enlistee)
Std. Error = 3.9
R2 = 0.447

Contact on advice of recruiter for another service:
Other = 3.8

These estimates of responses and standard error represent percentages of enlistees within a single reception battalion. Estimates for all new recruits combined must be computed by averaging the separate full-year estimates for the eight reception battalions. Those estimates should be weighted by the number of recruits at each reception battalion.

Circumstances of first contact. Responses to this question also are "well-behaved" and the 1987-88 pattern continued into 1989. First contacts at the recruiting station were lowest for summer accessions and greatest for winter accessions; the reverse was true for first contact at school. This pattern should be expected since recruiting efforts directed at high school students should result in more accessions right after graduation (first contact at school encourages accession after graduation). Other circumstances of first contact appear fairly constant across trimesters and years.

The percent of recruits choosing each alternative to this "under what circumstances did you first talk with an Army recruiter" question can be estimated from summer trimester data for each reception battalion by:

Talked by phone:
Phone = 21.6 + (0.477 * T_Phone)
Std. Error = 1.5
R2 = 0.570

Talked at a recruiting station:
RecrSta = 18.8 + (0.545 * T_RecrSta)
Std. Error = 2.5
R2 = 0.504

Talked at a job fair:
JobFair = 0.5

Talked at school:
School = 5.7 + (0.525 * T_School)
Std. Error = 1.8
R2 = 0.443

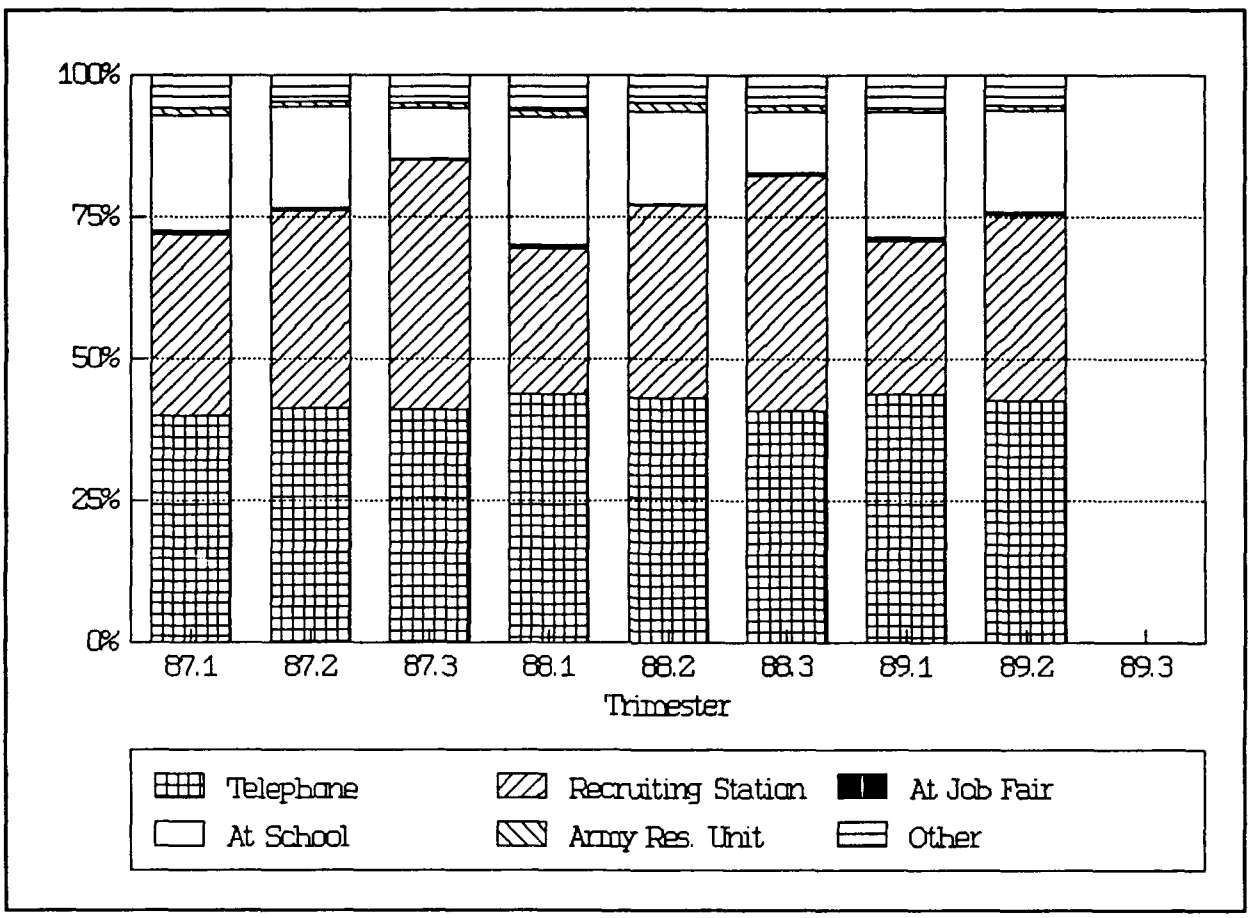

Figure 9. Circumstances of first recruiter contact, for all NPS recruits combined.

Talked at an Army Reserve unit:
ArmyReserve = 1.0

Other:
Other = 2.0 + (0.540 * T_Other)
Std. Error = 0.3
R2 = 0.854

Mean age at DEP. The recruit's average age in years at time of contract follows a pattern of being lowest for summer accessions (18 to 18.5 years) and greatest for winter accessions (20 to 20.5 years). This pattern should be expected from recruiting efforts: most high school graduates (younger enlistees) would be expected to access during the summer.

Age was averaged separately within each reception battalion for this prediction, so the equation applies to each reception battalion separately. An estimate of the full-year mean age at time of contract, for all recruits combined, can be found as the mean of the ages for the eight reception battalions, weighted by number of recruits surveyed at each reception battalion.

The mean age in years for enlistees (Age) for the full year is predicted from single-trimester data (AgeT) at each reception battalion by:

Age = 15.5 + (0.199 * T_Age),

with an error of estimate of approximately 0.27 years (R2=0.085).

Mean number of days in DEP. The mean number of days a recruit spends in the DEP follows a pattern that should be expected from recruiting efforts: The highest number of days is for those who accessed during the summer trimester. Presumably, those enlistees signed a contract during high school and required time to graduate before enlistment. Only five trimesters' data exist for this variable, so no prediction should be made at this time. If the pattern seen is replicated in the future, then it would be reasonable to create an equation to predict full-year data from single-trimester data. Such an equation should be accurate to about +/- 40 days or better, if conditions remain unchanged.

Gender composition. This demographic variable is quite "well-behaved", with the percent of women enlisting being greatest in the fall trimester and least in the summer. The large standard error of this prediction equation, however, suggests that its use may not as practical as the assumption that annual recruit populations have a nearly constant composition of 88.9% male. As in other estimation equations, this one predicts full-year survey responses within reception battalions. To compute the full-year overall estimate, the eight averages for different reception battalions must be computed and then averaged (sample-size weighted average).

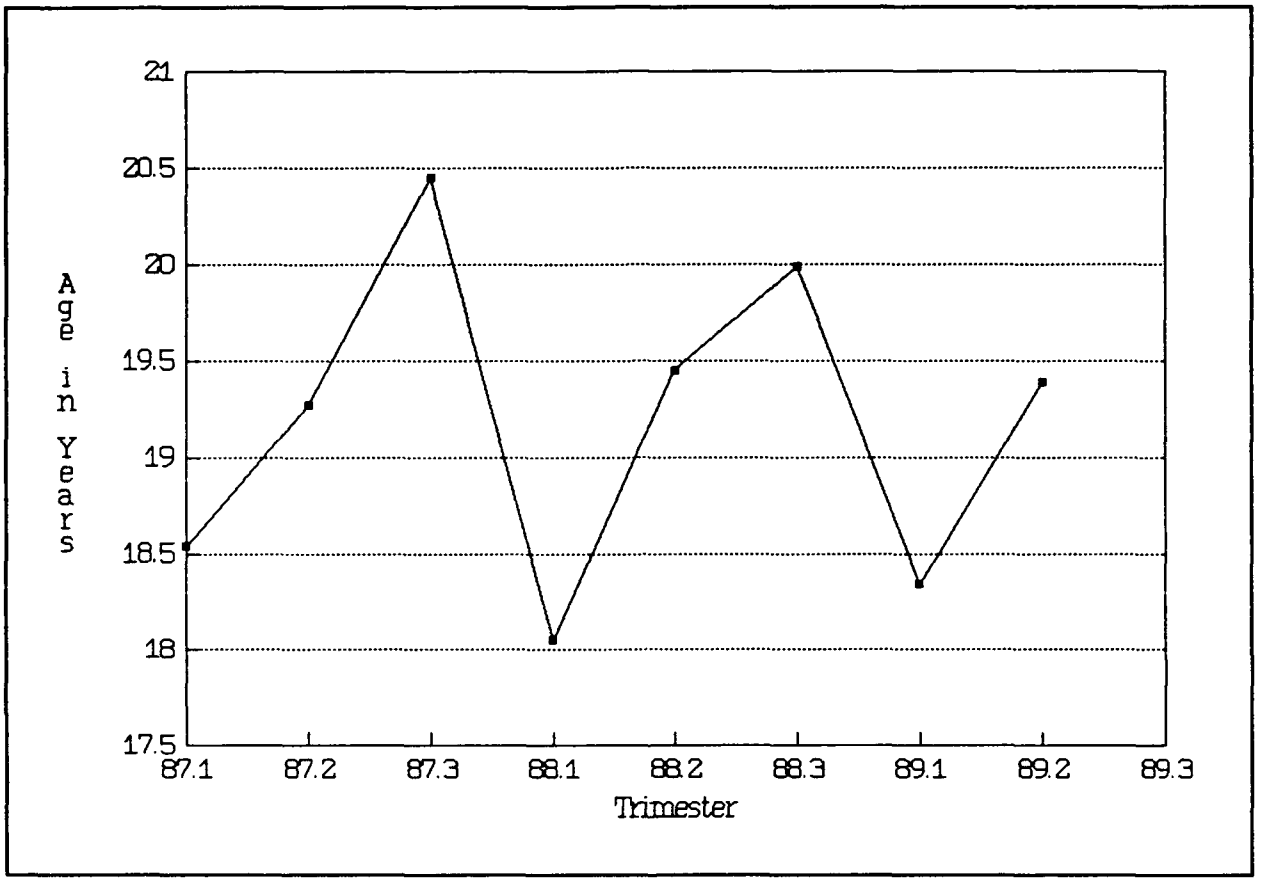

Figure 10. Mean age at time of DEP contract, for all NPS recruits combined.

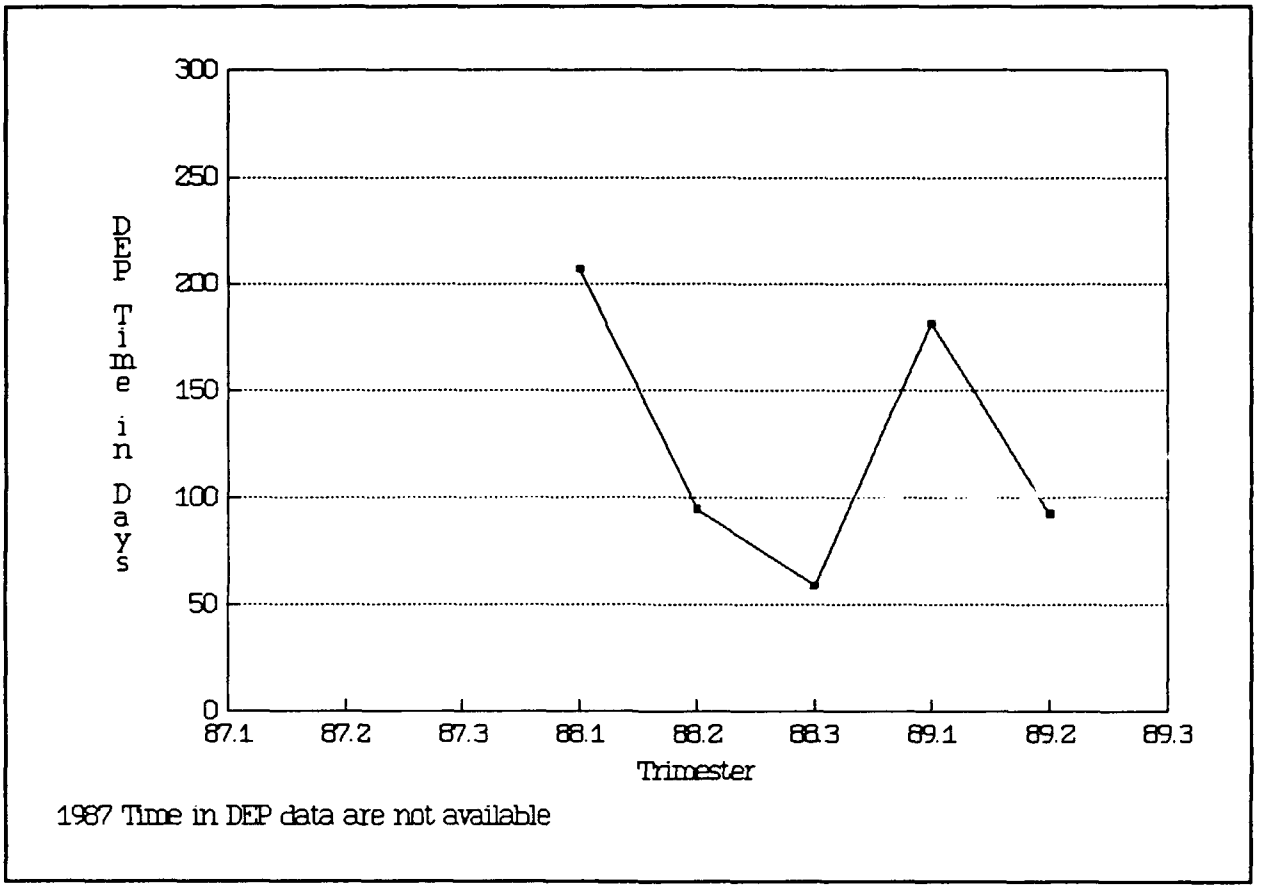

Figure 11. Mean number of days in the DEP, for all NPS recruits combined.

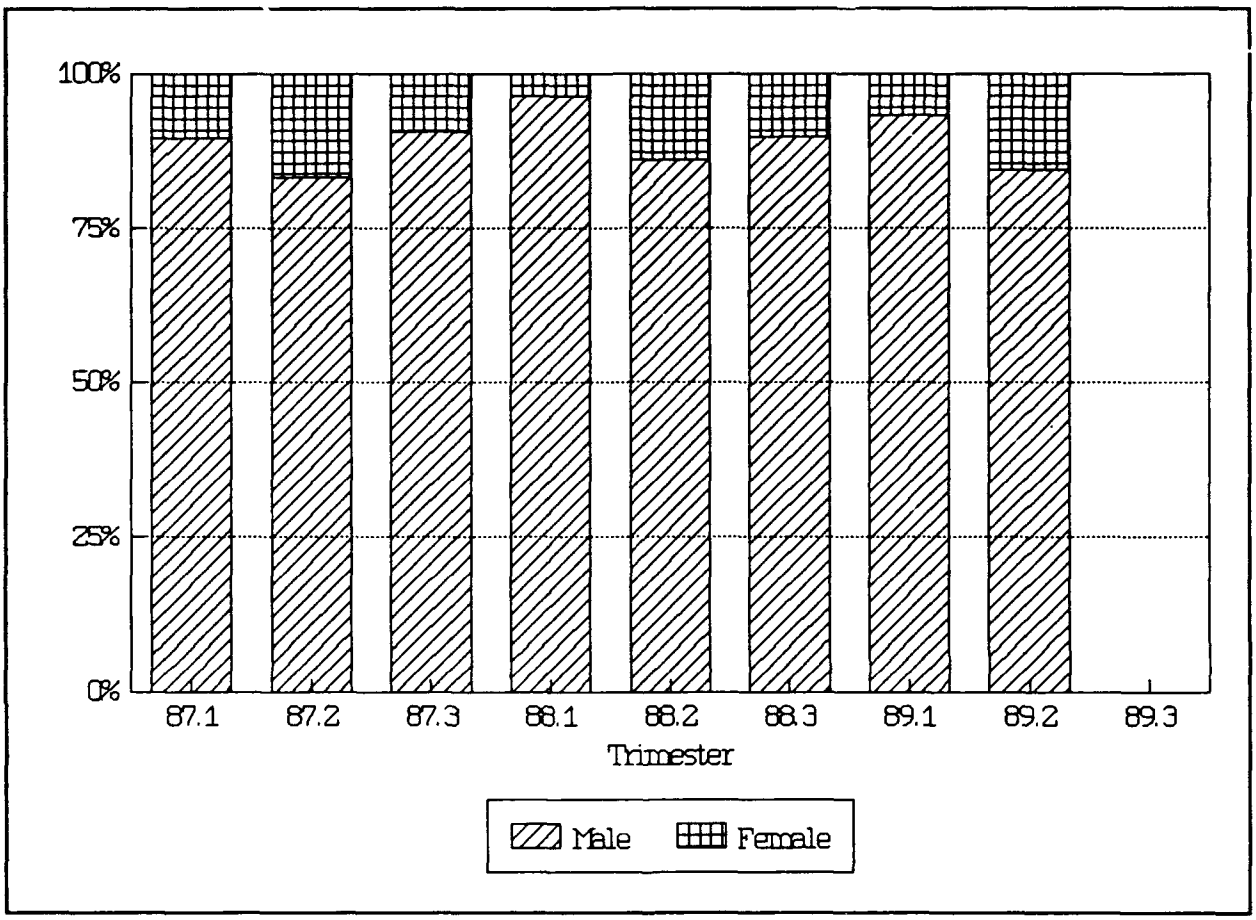

Figure 12. Gender composition, for all NPS recruits combined.

PctMale = -9.6 + 1.069 * T_PctMale
Std. Error = 6.0
R2 = 0.780

Ethnic composition. No patterns appear obvious in the ethnic composition of new recruits. However, percentage composition of each race does not vary widely from trimester to trimester. The equations presented here are reasonable for predicting ethnicity of the new recruit population despite the lack of obvious patterns across trimester. These equations predict percentages within each reception battalion separately.

Percent of White recruits:
White = 11.9 + (0.818 * T_White)
Std. Error = 4.4
R2 = 0.669

Percent of Black recruits:
Black = 4.1 + (0.829 * T_Black)
Std. Error = 3.9
R2 = 0.699

Percent of Hispanic recruits:
Hispanic = 2.3 + (0.511 * T_Hispanic)
Std. Error = 0.9
R2 = 0.346

Percent of recruits of other ethnicity:
Other = 1.6 + (0.500 * T_Other)
Std. Error = 0.4
R2 = 0.679

Geographic region. Weak patterns appear in the region from which recruits are drawn. Recruits from the Midwest and Northeast are most prevalent in the summer and least in the winter. Recruits from the Southwest and West are more likely during the winter and least during the summer. These equations are valid for estimating full-year percentages within each reception battalion separately.

Recruits from the Northeast:
NE = 8.8 + (0.463 * T_NE)
Std. Error = 1.8
R2 = 0.409

Recruits from the Southeast:
SE = 8.8 + (0.615 * T_SE)
Std. Error = 1.8
R2 = 0.536

Recruits from the Southwest:
SW = 9.8 + (0.581 * T_SW)
Std. Error = 2.2
R2 = 0.464

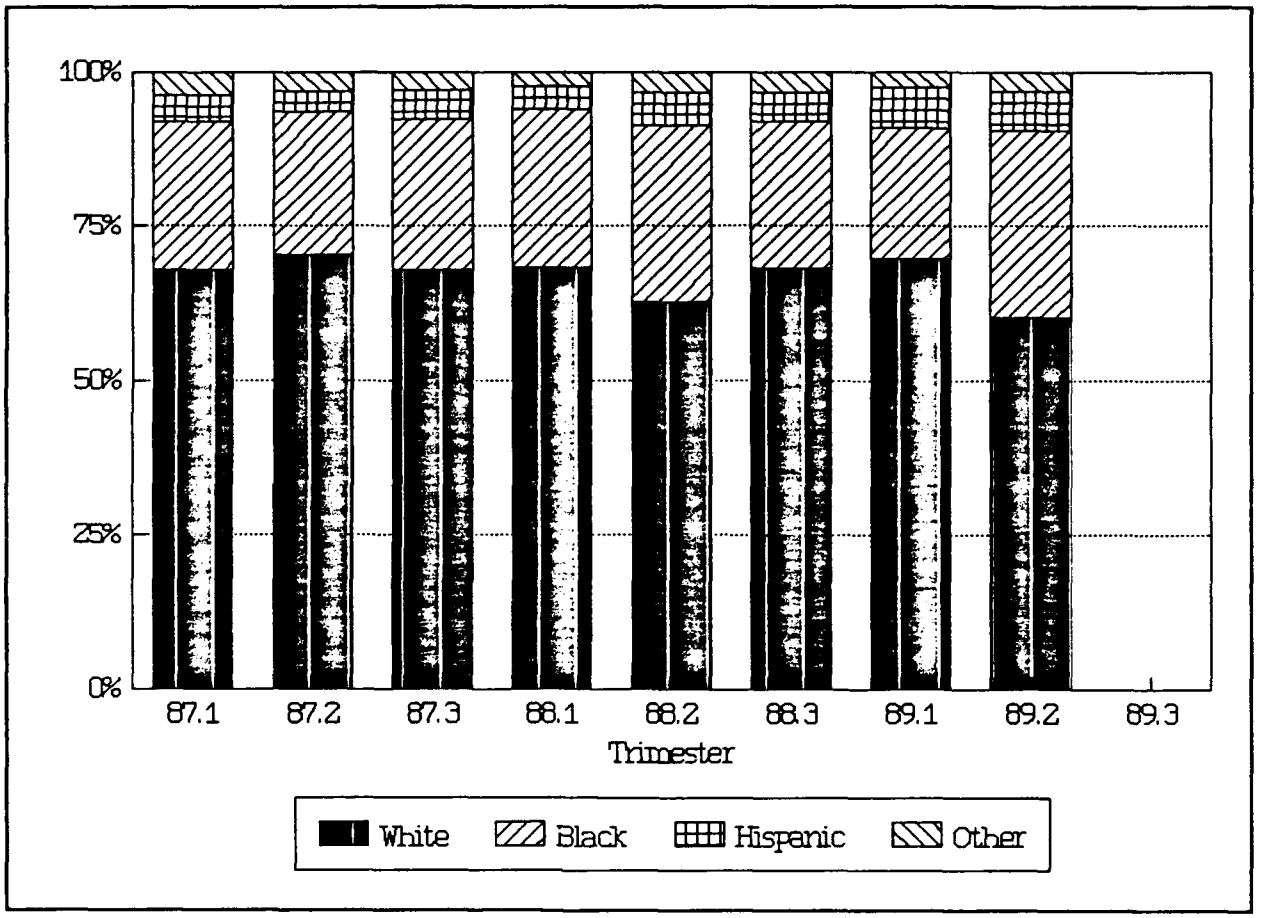

Figure 13. Percent ethnic composition, for all NPS recruits combined.

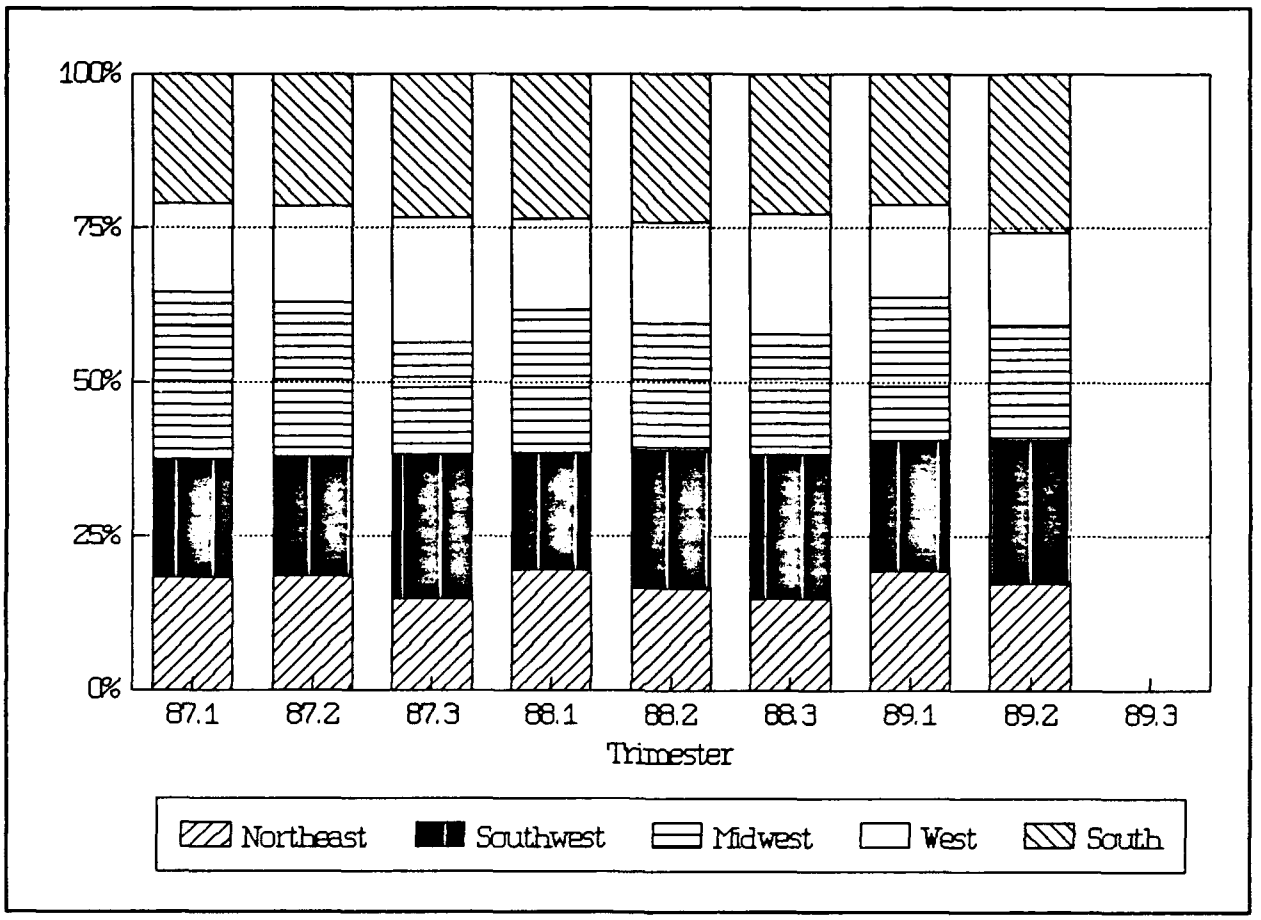

Figure 14. Percent from each geographic region, for all NPS recruits combined.

Recruits from the Midwest:

Midw = 4.7 + (0.704 * T_Midw)
Std. Error = 2.2
R2 = 0.753

Recruits from the West:

West = 6.7 + (0.679 * T_West)
Std. Error = 1.8
R2 = 0.537

Home town type. Patterns are visible in the percent of recruits from different types of home town. Recruits from large cities are more prevalent during the winter trimester and less likely during the summer. Recruits from rural or farm areas show the opposite pattern (most likely during the summer). The pattern seen here may be tied to the pattern seen in geographic region: Midwest, Northeast, and large city recruits are more likely to access during the winter trimester while recruits from the Southwest, West and Rural/farm areas are more likely to access during the summer trimester.

Recruits from large cities:

City = 10.5 + (0.533 * T_City)
Std. Error = 2.1
R2 = 0.416

Recruits from medium-sized cities:

Med.City = 12.9 + (0.288 * T_Med.City)
Std. Error = 1.7
R2 = 0.128

Recruits from suburban areas:

Suburb = 13.2 + (0.167 * T_Suburb)
Std. Error = 0.8
R2 = 0.148

Recruits from small towns:

Town = 13.6 + (0.437*T_Town)
Std. Error = 1.7
R2 = 0.312

Recruits from rural areas:

Rural = 10.5 + (0.455 * T_Rural)
Std. Error = 2.0
R2 = 0.501

As is the case with the estimation of full-year values for other variables, the estimation equations for geographical region are valid within reception battalions. Full-year estimates for all recruits combined are found as the weighted average of the eight separate estimates for the reception battalions.

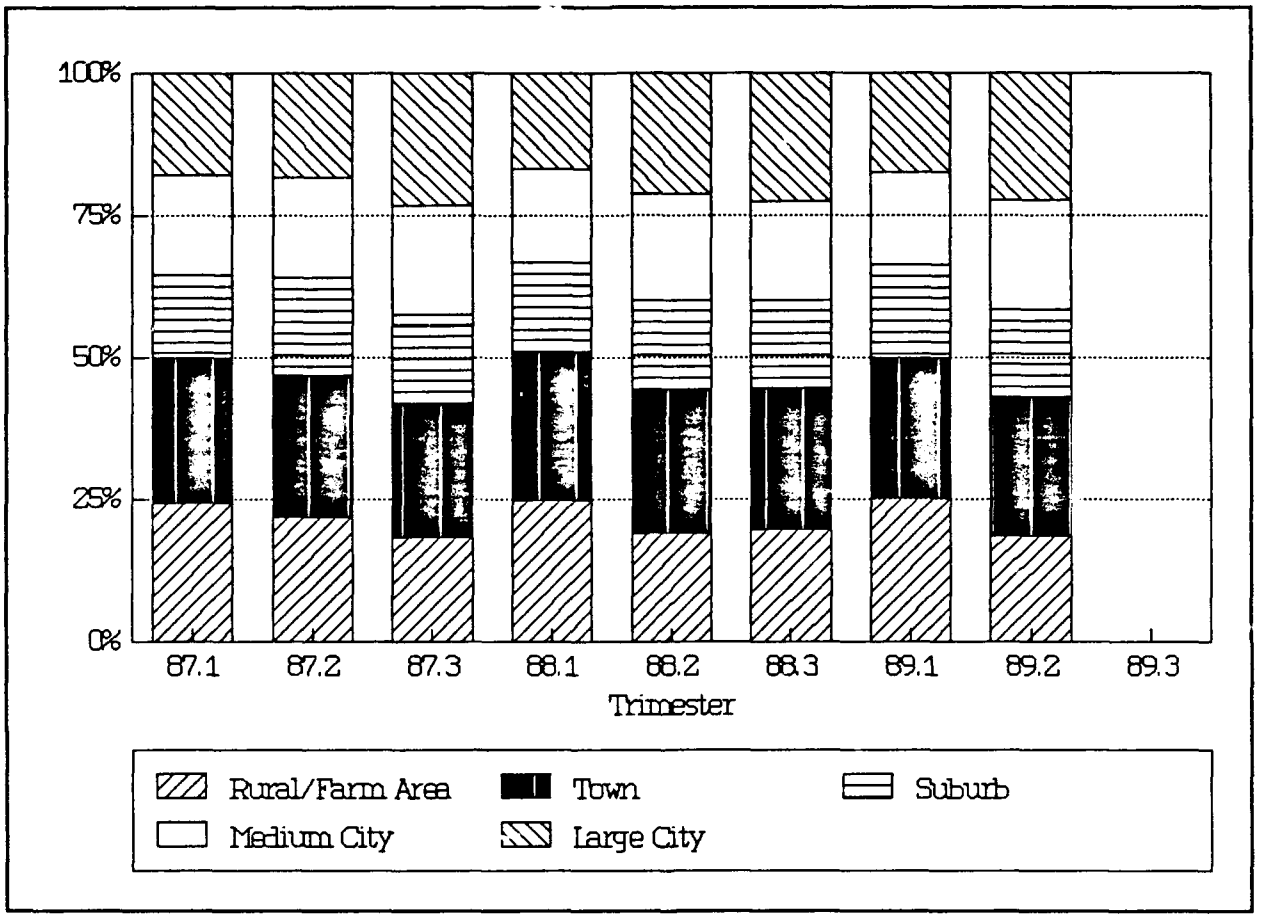

Figure 15. Percent from each hometown type, for all NPS recruits combined.

Items For Which Seasonality Effects Are Unimportant

Enlistment reason items and scales. Hay (1990) found statistically significant patterns in recruit responses to these items across trimester, but concluded that the magnitude of those patterns was so small that the patterns were unimportant. We agree with her conclusion, and offer an additional reason for the same conclusion: the order of importance of the enlistment reasons almost never changes from trimester to trimester. Enlistment for self-improvement is always the most important reason, followed by the opportunity to gain money for education. Equal opportunity for women is always the least important enlistment reason (even for women). Figures 16 and 17 display the mean response to these questions. We rank the importance of the different enlistment reasons as:

1. Self-improvement
2. Money for education
3. Physical training
4. Benefits
   Be soldier
6. Leadership training
7. Chance for high-tech work
8. Gain job skills
   Opportunity for travel
10. Equal opportunity for women

Further research into enlistment reasons. It is important to know as much as possible about the enlistment reasons of high-AFQT enlistees. For that reason, we examined trends in enlistment reasons across trimester and across AFQT category.

The enlistment reason scales were scored from 1=Not at all important to 4=Would not have enlisted without this, a rather condensed measurement scale. The scale is seen to be even further condensed if (as seems likely) very few items will be rated as 4's, and not too many will be rated as 1's. As a result, much of the differentiation between recruits will take place at scores between 2 and 3. A numerically small difference could have a large practical impact, but it is hard to determine that impact unequivocally.

There was no consistent pattern across AFQT levels for the importance of Benefits, Travel, Money for education, Leadership training, or Physical training. There is, however, a gradual decrease in importance of the other enlistment reasons as AFQT scores increase. There was a slight decrease (perhaps 0.10) in the importance of self-improvement and a clear decrease (0.30 to 0.40) in both the Importance of being a soldier and in Working with high-tech equipment. A large decrease in importance (0.40, possibly more) was seen in Gaining job skills and Equal opportunity for women as AFQT scores increased.

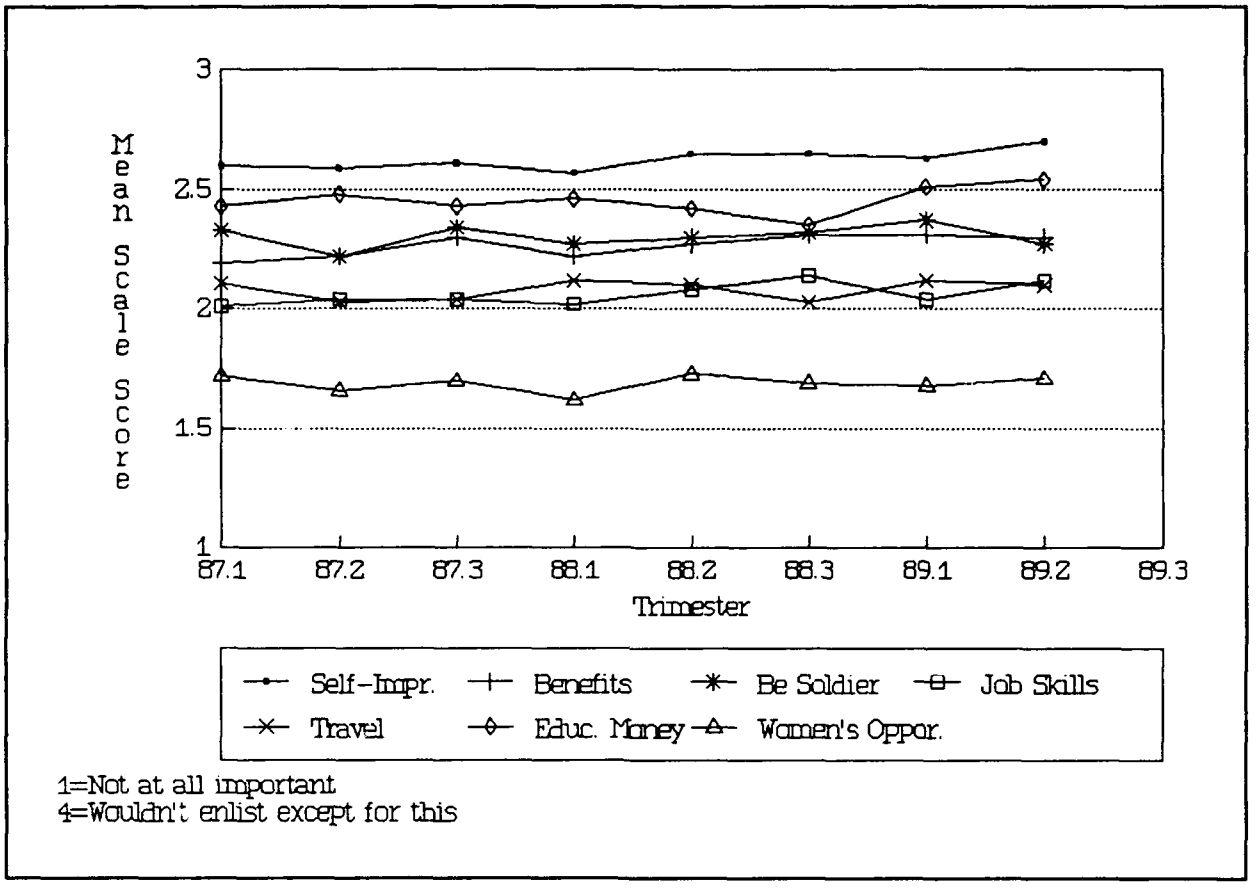

Figure 16. Enlistment reason scales, for all NPS recruits combined.

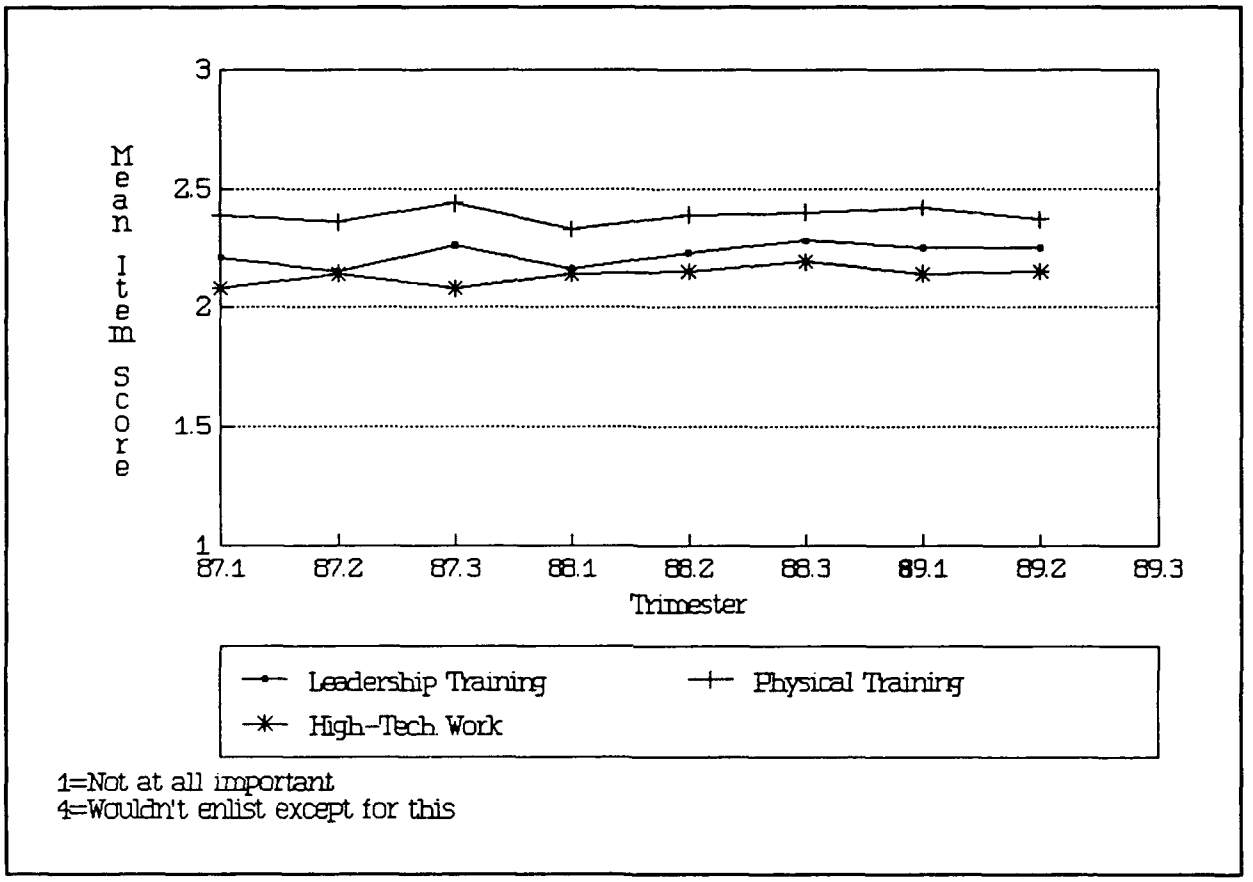

Figure 17. Enlistment reason items, for all NPS recruits combined.

It appears that high-AFQT recruits give the same importance to a number of enlistment reasons as lower-AFQT recruits, but less importance to gaining job skills, working with high-tech equipment, being a soldier, or equal opportunity for women. High-AFQT soldiers apparently come for self-improvement and education money and don't expect to receive useful job training. Benefits, leadership training and physical training are reasonably important for all recruits, and the opportunity for travel is somewhat less important (see Figure 17).

It was striking that equal opportunity for women was such a low-importance reason for recruitment. It was necessary to determine how women and men rated this reason separately in order to judge whether the low importance was a result of the fact that some 90% of all recruits are men (who would not be expected to care about equal opportunity for women). To our surprise, equal opportunity for women was also the least important enlistment reason for women.

Effect of loss of recruitment incentives. Three loss-of-incentive items were written for the MOS (effect if this MOS did not offer the incentive) and for all services (effect if no service offered the incentive). Removing cash bonuses had the least effect on likelihood of enlisting, and deleting the Kicker/ACF benefit had the greatest effect. Not offering the two-year option was almost as important as the Kicker/ACF benefit (see Figures 18 and 19). The effect on recruiting was more severe (would not enlist at all) if no service offered the benefit, as would be expected.

Conclusions

We have computed a set of prediction equations to allow estimation of certain NRS variables from summer trimester data. Those equations give fairly good estimations, but it must be remembered that if the social, economic or political environment within the United States changes substantially, then these equations may be rendered obsolete.

Other NRS variables could be predicted when conditions are more stable. Equations to predict full-year data from single-trimester data will need to be computed at that time. It is possible that the effect of the Persian Gulf war upon enlistment motivation could be estimated by comparing current data with transitional (the Gulf war) data and with future (stable) data. Such a future research project would not involve unusual statistical tools but would generalize only to conditions similar to the Persian Gulf war.

Thus the greatest obstacle to predicting full-year NRS responses from single-trimester data is our changing economic, social, political and recruiting environment. The effects of these changes were visible even in the 1987-89 data analyzed here, well before the Persian Gulf war. We can estimate full-

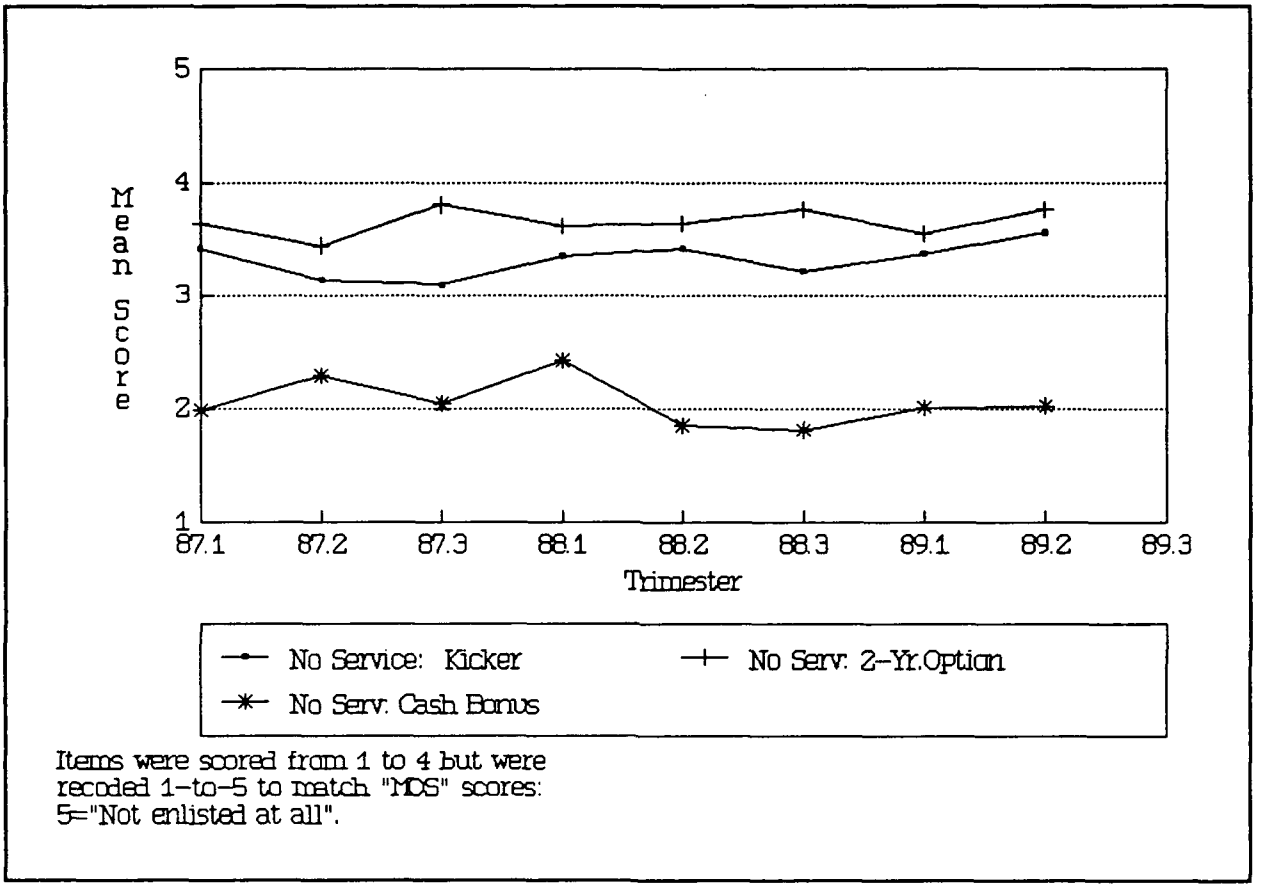

Figure 18. Effects of loss of recruitment incentives on those receiving the incentive, if no Service offered the incentive.

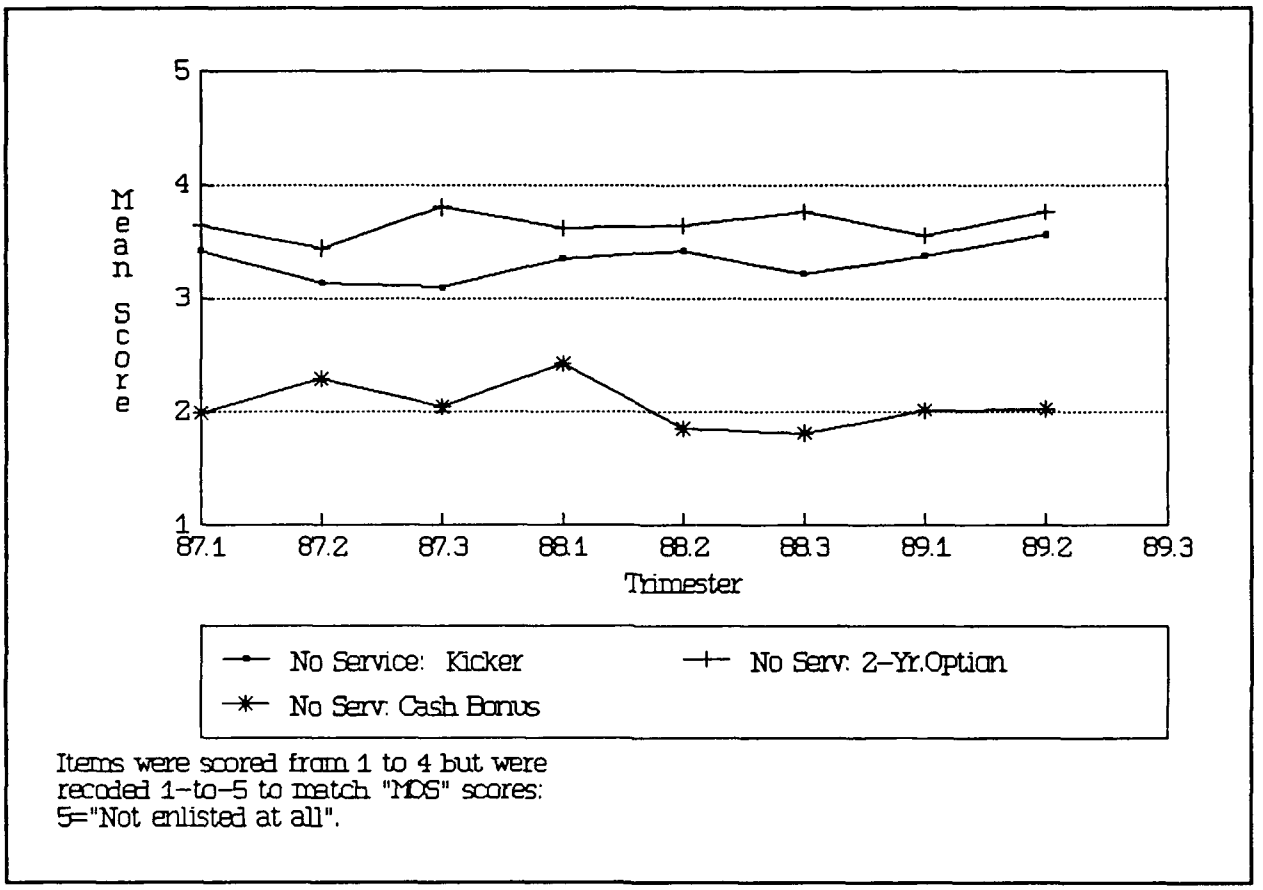

Figure 19. Effect of loss of recruitment incentives on those who received the incentive, if the MOS did not offer the incentive.

year responses from single-trimester data, but only when conditions are stable. Under our current conditions, even three-trimester data may be inadequate to fully measure new recruit characteristics such as AFQT category.

Some variables may not need predicting--their relationships are nearly constant across time. Enlistment reasons fall in this category, although their relative importance might be expected to change with, for instance, the Persian Gulf war. High-AFQT recruits are similar to other recruits in their enlistment reasons, except that they give less importance to gaining job skills, working with high-tech equipment, being a soldier, or equal opportunity for women. The most important enlistment reasons from 1987-1989 were self-improvement and gaining money for education.

A General Model of Prospect and Recruit Survey Sampling

As discussed in our section on the recruiting process, after recruiter contact, the recruitment management flow begins with an initial appointment at the recruiting station, moves to the application stage at a recruiting station, then proceeds to the contract stage at MEPS and ends with accession at the reception battalions.

Survey Methods

Data can be collected at each of these stages using different methodologies: group administered; telephone; mail surveys; and computer assisted surveys. Moreover, for each of these data collection methodologies at each stage of the recruitment flow, it is possible to evaluate their applicability, preferability, and practicability.

As Table 1 suggests, certain data collection methods will not be applicable, preferable or practicable at various recruitment sampling points. Moreover, certain data collection methods, while applicable, may not be either preferable or practical.

Appointments and Applications

Turning to the first two sampling points in the recruitment process--initial appointments and applications--the realities of the recruitment process preclude the administration of group data collection methods; hence the "no" cell entries in Table 1. All three of the other methods are theoretically applicable. While telephone and mail surveys would be possible at these first two stages, computer-assisted surveys would be preferable because the response rate will be higher when respondents are immediately available. Respondents typically find it more difficult to refuse a face-to-face request to complete the survey.

TABLE 1

Selection of Survey Administration Methods

Recruiting Process	Administration Method	Applicable	Preferable	Practical
Appointment	Group	No	NA	NA
	Computer	Yes	Yes	No
	Telephone	Yes	Possibly	Yes
	Mail	Yes	Possibly	Yes
Application	Group	No	NA	NA
	Computer	Yes	Yes	No
	Telephone	Yes	Possibly	Yes
	Mail	Yes	Possibly	Yes
Contract	Group	Yes	Yes	Yes
	Computer	Yes	Yes	?
	Telephone	Yes	Yes*	Yes
	Mail	Yes	Yes*	Yes
Accession	Group	Yes	Yes	Yes
	Computer	Yes	Yes	?
	Telephone	No	NA	NA
	Mail	No	NA	NA

* These methods are preferred for those who do not contract (i.e., PQs & QNEs). Group and computer methods are preferred for those who do contract.

NA = Not applicable ? = Based on computer availability

While computer-assisted surveys would be theoretically preferable to mail or telephone surveys, the realities of the recruitment process at the initial appointment and application stages make such a method impractical. Specifically, recruiters would be hard-pressed, given the stressfulness of their workload, to administer surveys to samples of potential recruits. Furthermore, attempts to collect additional data at these points could have adverse consequences for the success of the recruitment process. By contrast, both telephone and mail surveys are practical--neither would add to the burden of the recruiters, nor would they jeopardize the likelihood of recruits proceeding to the next stages of the recruitment process. Therefore, our sampling models for the initial appointment and application stages include only mail or telephone data collection methods. (It should be noted, however, that the spreadsheet will allow for the estimation of costs and errors associated with computer-assisted surveys at these stages.)

Contracts

For the contract stage of the recruitment process, the analysis becomes more complex. First, all four data collection methodologies are theoretically applicable at the contract stage. Furthermore, it is desirable to distinguish among surveys of partially qualified respondents, qualified but not enlisted respondents, and those who actually sign contracts at the MEPS. With these distinctions in mind, the preferability of data collection methods can be assessed. For example, among those who do sign contracts, it is preferable to use either group administered or computer-assisted surveys for several reasons. First, the convenience and availability of new recruits in one location would in principle facilitate data collection by either method. Second, there is a great deal of variability in the time between contract and accession, and the use of either telephone or mail surveys would result in sampling bias against those with a short time until accession.

Among those who qualify but do not sign a contract, however, the preferable data collection methods will be different. Since recruiting personnel are trying to convince potential recruits to sign contracts throughout their visit to the MEPS, attempting to administer a survey to them at the MEPS is administratively not feasible. It would therefore be preferable to contact them later, by mail or by telephone.

In terms of practicability, only computer-assisted surveys pose a potential problem. The availability of sufficient computers and their use for Army surveys at the MEPS is problematic. As a result, the group administered option may be more practical at this point in time, although telephone and mail surveys can be done. The advantage of group administered--relative to telephone or mail--surveys in this context has already been described.

Accessions

At the accession point, only group or computer-administered data collection methodologies would be applicable. Neither telephone nor mail surveys would be applicable because of the nature of the accession process, these methodologies would be better suited to following respondents post accession. As a result, either group administered or computer-assisted surveys would be preferable at the accession sampling point. Group-administered surveys would be more practicable, particularly in the absence of sufficient computers. These data collection methodologies must be considered in terms of different sampling points and by weighing costs and benefits. The next section addresses these issues.

Costs and Benefits

The previous analysis has narrowed our focus to the use of telephone and mail surveys at the first two sampling points; group administered (for those who contract) and telephone or mail surveys (for those who are partially qualified and who choose not to contract) at the contract stage; and group administered surveys at the accession point. As a consequence, our discussion of the general model of the recruitment process will only consider the costs, errors, and benefits of these combinations of sampling points and data collection methods for prospect and recruit sample surveys. We will hereafter refer to these combinations as "viable sampling strategies."

First, it is important to consider the costs and non-sampling errors associated with each viable sampling strategy. For each strategy, there are several categories of costs that we have incorporated into the spreadsheet: survey project management; survey creation; survey publication; survey administration; and data capture. Each of these cost categories can be broken down further. Survey management, for example, includes: selection of survey sampling plan; soliciting bids for all or part of the survey project; awarding contract(s) for the project; ongoing project management; other project management expenses; data analysis; and project report. Survey creation includes: instrument design; pilot testing of the survey; and survey revision. Survey publication includes: creating physical copies of the survey or the cost of creating computerized copies. Survey administration includes: sending the survey to administrators; administering the survey; shipping it back to the survey manager. Finally, data capture includes: data entry, codebook creation, and data transport.

With these cost categories in mind, let us consider the basic costs associated with telephone and mail surveys at the initial appointment and application stages. When comparing cost effectiveness of telephone versus mail surveys, only two categories of cost are particularly relevant. First, as sample size increases, the survey administration costs of telephone

interviews will increase rapidly if there is a need to have more CATI stations, supervisors, and trained interviewers. These are expensive items. Second, however, the data capture costs for CATI interviews are much smaller than those for mail questionnaires, which must be coded and entered into the computer. A CATI system, however, provides for immediate and cheap data capture when the interviewing takes place. These competing cost considerations are explicitly taken into consideration by our spreadsheet prototype, described in this report. The more cost effective method can be determined by applying the model incorporated in this prototype.

With regard to costs associated with viable sampling strategies at the contract stage, let us first consider those who become new recruits. First, it should be noted that the use of computer-assisted data collection at the MEPS is predicated on the availability of sufficient computers to handle the large samples ordinarily employed by USAREC. If a large capital investment is required, then the costs of this method of data collection would be prohibitive. Assuming availability, the data capture costs and survey administration costs of this method would be far less than the group-administered option.

Second, considering those who qualify but decide not to enlist as well as those who are partially qualified, we have recommended the use of mail or telephone data collection methodologies. The cost considerations are therefore identical as those described above for the initial appointment and application stages. For these individuals and for those who decide to contract, the most cost effective method can be determined by applying the model incorporated into the prototype spreadsheet.

As with the contract stage, cost assessments for the accession stage must begin with a caveat about the availability of computers at the reception battalions in order to employ computer-assisted data collection. Assuming availability of the appropriate hardware (and software), under most circumstances this method would be more cost effective for the reasons we have already discussed. Again, cost estimates can be generated by the spreadsheet prototype.

In addition to cost considerations, both sampling and non-sampling errors are important to include in any assessment of viable sampling strategies at each stage of the recruitment process. Sampling errors are quantitative and can easily be incorporated into the model implemented in our spreadsheet. Non-sampling errors, however, are qualitative and although they are important, are extremely difficult to model and therefore not incorporated in the spreadsheet. Non-sampling errors such as response bias, ease of contact, data entry errors, mobility of the population of interest, all have a bearing on the viability of a particular sampling strategy for a particular sampling point.

Benefits by Sampling Point

In this brief section we will focus explicitly on the benefits for valid scientific inferences provided by collecting data at each of the four potential sampling points. In all cases, the purpose of the survey is the key element. The types of inferences desired and the definition of the population of prospects determines which point in the recruitment process is optimal.

Collecting data at the initial appointment stage provides several potential benefits. First, surveying the pre-commitment population provides better assessments of the effectiveness of advertising and marketing strategies than later sampling points. As prospects progress to each successive stage of the recruitment process, a variety of social and psychological factors conspire to create distortions in the accuracy of self-reports about the nature of pre-commitment decision-making. Furthermore, at each successive stage in the recruitment process, the population is systematically narrowed. The population of prospects is closest to the target population, but it shrinks at the application stage, shrinks further by the contract stage, and yet further by the accession stage. The result is that vital information about the pre-commitment information environment is even more distorted by the self-selection inherent in this process. In other words, the control group is slowly disappearing.

Second, collecting data at initial appointments would provide an important baseline to compare those who eventually access with those who drop out along the way. Only by collecting such data can systematic improvements in marketing and advertising strategy be made. In general, the principle of sampling directly from the population affected by an intervention should be followed as much as is practical. For example, the most appropriate sampling population for evaluations of marketing and advertising effectiveness is the population of eligible youth.

Collecting data at the application stage involves winnowing the prospect population. Those who were not serious about potentially joining the Army are unlikely to proceed beyond the initial appointment. However, those who seek additional information about careers and benefits--who proceed to the application stage--may better reflect the population of interest to the Army Recruitment Command. Thus a potential benefit of sampling at this stage is that a target popula ion ripe for persuasion has been identified. This provides a better base for analyzing the recruitment process per se, although it is not as helpful as the initial appointment stage would be in assessing the effectiveness of marketing and advertising strategies.

Collecting data at the contract stage has a potentially important role in evaluating why some prospects decide to opt out of the recruitment process and why others decide to proceed. If-

-as we recommend--mail or telephone surveys of the partially qualified or qualified but not enlisted are conducted, it would be possible to gain incisive information about those variables that contribute to an understanding of the role of the recruitment process per se. In addition, it would contribute to an understanding of the role of those preexisting demographic and psychographic factors which may predispose the partially qualified or qualified but not enlisted to exit the recruitment process.

Another benefit of sampling at the contract stage is that it would allow researchers to evaluate the differences between the recruits who access and those who do not. This comparison may be even more valuable than that between those who contract and those who do not. The population of interest at this stage is even more narrowly focused on post-decision pre-action prospects who appear to be headed toward accession. As such, the roughly 15% who contract but do not access may be the subject of intensive inquiry for purposes of improving the efficiency of the recruitment process. Because prospects who have gone this far in the process are more likely to go further than those who have merely met an initial appointment, funds spent at this stage may have a far greater impact on the overall success of the process than similar funds expended earlier in the process.

Finally, continuing to collect data at the accession stage has obvious benefits. First, it allows continued comparisons for time series analysis with the NRS data base already collected by USAREC. Second, it can continue to serve as a baseline for evaluating the effectiveness of Army policies which apply to new recruits. Recruits who access can then be studied as cohorts throughout their Army career, particularly if panel designs are adopted. Third, data collected at this point can provide critical comparisons with data collected at earlier stages of the recruitment process aimed at assessing marketing and advertising strategies, as well as evaluating specific characteristics of the recruitment process.

Assessing Tradeoffs between Costs and Errors: A Methodological Note

A critical factor in assessing the optimal tradeoff between costs and errors for the design of surveys concerns identifying the size of a practical difference for changes in survey responses. Because of the large potential size of the sample for prospect and new recruit surveys, very small differences in responses can be detected. Given this fact, the criterion of statistical significance can lose its importance as a reliable indicator of meaningful differences.

Therefore, we suggest that other strategies must be employed for the determination of a criterion of practical significance. For example, two such strategies were identified in semi-structured interviews that we conducted with Army recruiting

experts (the protocol is included in Appendix A). One criterion is to determine the amount of change in responses needed in order to change the rank order of response alternatives, then set sampling error to just below that amount. Another strategy is to determine the amount of change in responses needed to achieve a financial breakeven point for the enlistment incentive or recruiting practice being assessed by the survey. Other strategies are undoubtedly possible and can be identified by additional study of the objectives and strategies of decision makers.

A complete study of these alternative approaches to determining the size of a practical difference in survey responses is beyond the scope of this project. However, this issue can be further pursued in one of two ways. One approach to this issue is to have decision makers scale alternative decision situations. Two example situations are described in Appendix B. A second approach is to study decision makers' use of the prototype survey spreadsheet in making their evaluation of the tradeoffs between costs and errors.

Overview of Potential Sampling Strategies

To further develop our recommendations for sampling models, in this section we provide an overview of sampling strategies available for each of the four stages of the recruiting process. Researchers could select one of five basic models: simple random sampling (SRS), stratified proportional (SP), stratified disproportional (SD), cluster (C) or stratified cluster (SC). Each of these models and their advantages and disadvantages is defined and discussed in basic texts on survey research and sampling (Benedict, 1987; Benedict, 1988). Here we will provide only an overview of these sampling models.

Random Sampling

In an SRS, each element--and all combinations of elements--in the population have an equal probability of being included in the sample. Ordinary inferential statistics as presented in introductory statistics textbooks assume that the data analyzed were generated by an SRS. We have found very few examples of the use of SRS in military surveys or in surveys commissioned by the military (Sullivan, Borgida, and Carter, 1988). With the increasing use of CATI systems, however, and the development and feasibility of random digit dialing (RDD) methods, it becomes increasingly plausible for the military to do random sample telephone surveys.

In systematic random sampling, the size of the population is divided by the desired sample size to obtain a skip interval, k. Then a random digit is selected between 1 and k as the starting point. This random digit is the first case selected, and then every k-th subsequent individual is selected for the sample.

Stratified Sampling

Stratified sampling represents another major sampling strategy. It involves obtaining random samples from subgroups, or strata, of the population of interest. This approach can increase sampling efficiency and precision when there is sufficient information available to identify and sample the strata. For example, because Army recruits are predominantly youth (e.g., in 1977, over 95% of the recruits were younger than 25), subgrouping and sampling the population based upon age is a more efficient sampling strategy than randomly sampling the population as a whole. Effective stratified sampling procedures require dividing the population in some meaningful way (e.g., by age for Army recruiting) and having the required information to sample individuals within each strata. There are two general approaches to stratified sampling: proportional and disproportional.

In proportional stratified samples, the number of cases selected within each stratum is proportional to the stratum's size. So if one stratum is 25% of the population, then 25% of the sample is drawn from that particular stratum. Some military samples are proportional stratified samples, done in order to increase sampling efficiency. Currently, most military researchers sample systematically within strata, with a random selection of the last two digits of the Social Security number used to identify the respondents to be surveyed.

In disproportional stratified sampling, the number of cases is not proportional to the size of the stratum in the population. Disproportional stratified sampling is used for several purposes in military surveys. First, it has often been used to study small subpopulations, to make comparisons with the rest of the population. So, for example, in studies focused on whether women officers differ from other officers and enlisted personnel on some set of variables, the sampling design will be stratified to oversample women officers because there are so few of them. In an SRS, unless it was a very large SRS, there would be so few women officers that their results could not reliably be compared with those obtained from other subpopulations (the margin of error would be too large). In studies using disproportional stratified sampling, the results should be weighted during data analysis so that when strata are pooled for an overall analysis, the sample will reflect each stratum's proportion of the total population.

A second use for disproportional stratified sampling has been to correct for differential response rates across strata. For example, for many of the Defense Manpower Data Center (DMDC) surveys which cover all four service branches, sampling is disproportionally stratified by branch because response rates in the Air Force are generally higher than in the Army. An SRS would, in the final analysis, underrepresent the Army in cross branch surveys, and would underrepresent enlisted personnel in

surveys done within a particular branch. In these instances, then, disproportional sampling is used to compensate for unequal propensities to respond to surveys, with the target being a set of completed questionnaires that reflect each stratum proportionately.

Cluster Sampling

Cluster samples represent another major strategy for sampling large populations. Similar to stratification, it involves dividing the large population into sub-groups, called clusters. In contrast to stratification, the sub-grouping strategy is based upon geographical convenience rather than the substantive variables used for stratifying populations. Cluster sampling is not as efficient or precise with respect to sampling error as is stratified sampling. However, it is an efficient, practical approach when insufficient information exists for stratified sampling and when natural sub-groups are available (e.g., MEPS or reception battalions).

In cluster sampling, the population is divided into adjacent clusters of units, and a random sample of clusters is taken. Researchers then choose some proportion of the elements in each randomly selected cluster. It could include all of the respondents or some specified percentage of them. The selection of units within clusters can be done in different ways, including randomly. The purpose of cluster sampling is usually cost-effectiveness and it is done when the population under study is large, heterogeneous, and dispersed. Clustering should therefore be done so as to maximize heterogeneity within clusters. Each cluster should ideally be as heterogeneous as the population, to represent its diversity. Cluster samples are generally less efficient than SRS in terms of sampling error. To the extent that the heterogeneity assumption is violated, this loss of efficiency is increased.

Cluster sampling can be combined with stratified sampling when referring to the process of selecting subgroups within clusters. Cluster sampling is most common among military studies of the general population, reservists, veterans, or youth studies. Research that involves telephone interviewing does not require cluster sampling. Cluster sampling is ordinarily used when face-to-face interviewing among dispersed populations is a necessity, and it will be increasingly rare. Most military and civilian personnel are already clustered together in common locations, rather than spread out as is the general population.

In the next section of this report we discuss how these different sampling strategies may be utilized at the different stages of the recruitment process.

Selecting Sampling Strategies by Recruitment Stage

Examining first the initial appointments and application stages of the recruitment process, for which we have recommended data collection by mail or telephone, it is likely that an SRS would be preferable because conventional formulae for calculating standard errors assume SRS (although correction formulae are available in several texts for non-SRS samples). The prototype for our spreadsheet model, at this stage, assumes SRS. Assuming that a list of the population is available with name, address, and phone number, it would be a simple matter to merely select either a pure SRS or a systematic random sample with a skip interval designed to produce the required sample size.

We can identify no obvious reason to select a stratified sampling method, unless the purpose of the survey requires researchers to study a subgroup that makes up a small proportion of the total population. For example, if a smaller percentage of some targeted subgroup such as women or AFQT-I are actually proceeding from initial appointment to application, researchers may wish to oversample these subgroups to identify the predictor of success for individuals in each subgroup. In this case, an SRS model would not apply and a disproportionate stratified sampling model would be required. If this sampling model is adopted, the formulae for estimating standard errors would have to be adjusted.

If telephone or mail surveys are utilized, we can identify no particular need for proportionate stratified or any form of cluster sampling models.

Examining next the contract stage of the recruitment process, we have recommended the use of group or computer-assisted administration methods (at the MEPS) for new recruits, and the use of telephone or mail for those who are partially qualified and qualified but not enlisted. The recruitment flow at the MEPS in large part dictates that individuals be tested within groups. As a result, when studying new recruits, SRS and stratified sampling models are less feasible; they would require the presence of both a full time administrator to randomly draw subjects for surveys and some way of building into the system the possibility of an individual's being selected to complete a survey. Instead, entire populations will probably be tested en masse, or some form of cluster sampling might be employed. If so, each MEPS should contain as diverse a sample as possible, reflecting the diversity of the population as a whole.

For the partially qualified and those who qualify but do not enlist, SRS would be preferable for the reasons given in our discussion of sampling at the appointment and application stages.

Finally, for the accession stage of the recruitment process, we have recommended the use of group-administered data collection (depending upon availability, computer-assisted data collection

also may be a viable strategy). As with data collection at the MEPS, data collection from new recruits at the reception battalions is most conducive to group testing. As a result, either using the entire population or some type of cluster sampling would be appropriate at this final sampling point.

While a discussion of viable sampling strategies for each stage of the recruitment process is crucial to understanding the general model we have developed, it is also useful to evaluate different sampling strategies as a function of research goals and design considerations. As may be seen in Figure 20, different research design considerations can suggest different decision rules for the selection of sampling methods. For example, if it is most practical and efficient to survey the entire population, then no sampling method would be required. On the other hand, if one wishes to use sampling methods to estimate population parameters, then unless one wishes to analyze responses by multiple subgroups then one should attempt to use SRS or systematic random sampling.

Along these lines, as shown in Figure 20, if one wishes to analyze responses by AFQT, race, and gender simultaneously, then one would be well-advised to consider the use of disproportionate stratified sampling. This of course assumes that one can randomly select people within strata. If this is not possible, then one may be forced to randomly select clusters of individuals relying on either stratified cluster sampling or pure cluster sampling. For example, in a study of new recruits, one could rely on cluster sampling methods if the reception battalions each contain sufficient diversity. If this condition is met, then one could select fewer than eight reception battalions for research purposes. A similar arrangement could be applied to sampling at the MEPS or sampling at the recruitment stations.

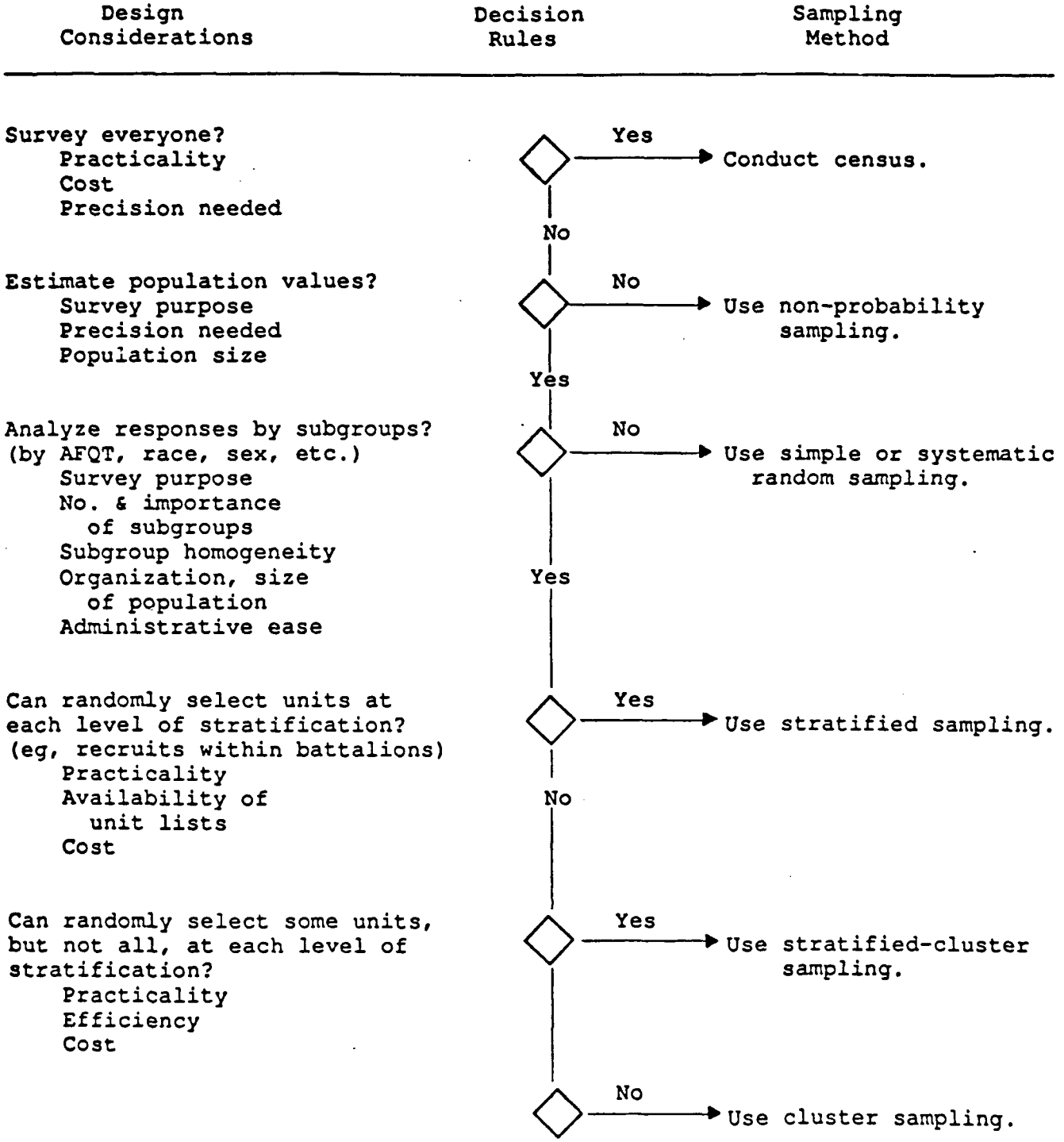

Figure 20. Decision tree for selecting a sampling design.

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APPENDIX A

INTERVIEW PROTOCOL

Project Purpose:

To assist the Army in identifying the costs and errors associated with alternative designs of marketing, program evaluation, and sales satisfaction surveys.

Meeting Objective:

To improve survey designs by learning more about how survey information is used in management decision-making.

Method:

A semi-structured interview protocol will be employed to explore how survey information is used. Viewing USAREC decision-making as a systems process, we will discuss outputs (e.g., the types of decisions such as choice of advertising mediums), decision processes, and inputs (i.e., survey information). Then we will discuss ways in which survey costs and design expertise can best be structured in a spreadsheet product to assist USAREC personnel. These topics are summarized below.

Meeting Topics:

1. Description of decisions affected by survey information.

2. Relative importance between types of information available from the new recruit survey.

3. Description of the possible problems associated with conducting new recruit surveys using alternative approaches (differing sites, methods, sampling procedures, etc.).

4. Description of possible end uses of, and modifications to, the Survey Spreadsheet which is being developed for this project.

5. Discussion of logistics of questionnaire exercise.

DECISIONS AFFECTED BY SURVEY INFORMATION

What decisions does information from New Recruit Surveys affect?

- Publicity
  - National
  - Local
    - Golden Knights
    - Medical exhibits

- Advertising (choice of medium, budgets, target audience, message content, etc.)
  - National
    - TV/Radio
    - Magazines
    - Direct Mail
  - Local
    - Newspapers
    - Radio

- Recruiter Effects
  - Personal Characteristics (selection, training)
  - Activities (1st contact, location of contact, DEP contacts, etc.)
  - Goals

- Incentives (Choice of incentive, level offered, MOS targeted, AFQT, etc.)
  - Bonus
  - Scholarships
  - Training
  - Choice of MOS
  - Choice of location

- Practices
  - Methods (local marketing, etc.)
  - Goals (BN, CO, RS, recruiters)
  - Territories

- Policies
  - Qualifications
  - MOSs

- Allocation of other resources (manpower, exhibits, equipment)?

- Effectiveness indices for BNs, COs, RSs, recruiters?

Others?

Please rank order the importance of survey information for each of the variables listed above (i.e., publicity, ads, incentives, etc.).

In what ways is survey information important to these decisions?

What other information is NRS information combined with in order to be useful for management decisions? (e.g., AFQT scores, job performance, etc., YATS, demographic data, economic data)

What other types of information are used?

What are the external factors that typically constrain these decisions? (e.g., Congressional mandates, budgets, DOD policies, etc.)

What other events have shaped policy?

How else is NRS information used? (e.g., to monitor demographic or psychographic changes, to assess effectiveness)

How important is each type of survey information (please rate on the next page)?

How much of a difference in survey responses is needed before it is noticed and considered important?

Before actions are taken?

Before changes in policies or practices are made?

	Importance *	Survey Variables	Change Noticed	Actions Taken	Changes Made
1		First Contact			
2		Contact location			
3		Appointment influences			
4		Enlistment influences			
5		Preferences for Army attributes			
6		Information from recruiter			
7		Information from GC			
8		Recruiter contacts in DEP			
9		Recruiter meetings in DEP			
10		Contact satisfaction			
11		New GI Bill			
12		Educational bonus			
13		2 yr enlistment			
14		Enlistment bonus			
15		Army college fund			
16		Option hypotheticals			
17		Term of enlistment			
18		Term hypotheticals			
19		Employability perceptions			
20		Enlistment alternatives			
21		Post enlistment alternatives			
22		Referral attitudes			
23		Type/source of information rec'd			
24		Home town size			
25		Pre-enlistment activities			
26		Educational expectations			
27		Job search activities			
		Recent employment			
28		type			
29		length			
30		earnings			
31		opportunities			
32		Relation of MOS to work			
		Parents'			
33		education			
34		income			
35		occupation			
36					
37					
38					
39					
40					

* Importance =
Hi = 1
Med = 2
Lo = 3

Which survey information is important for each decision output?

National Publicity

Local Publicity

National Advertising

Local Advertising

Incentives
- Bonuses
- Scholarships
- Training
- Choice of MOS
- Choice of location
- Others?

Practices
- Methods
- Goals
- Territories
- Others?

Policies
- Qualifications
- MOSs
- Others?

What other groups utilize NRS data?

How might their priorities differ from those listed above?

What kinds of problems or errors for USAREC could result from sampling errors in the survey?

For the Army?

Please specify the types of decision errors that could occur due to large(r) survey sampling errors.

Sampling Errors for Survey Topics	Management Decision Errors
1st Contact goals	Inappropriate recruiter
Appointment influences	Wrong ad/publicity methods
Enlistment influences	Wrong ad content/emphasis
Attitudes	Wrong sales emphasis
Information available goals	Inappropriate recruiter
Incentives to enlist effectiveness/vacancies	Lower
Job alternatives incentives	Ineffective level of
Employment	
Educational expectations ads/incentives	Wrong emphases in
Parents' work/educ./income ads/info	Wrong placement of
	Other errors?

For each type of credible decision error, list the types of costs incurred from that error.

What types of benefits could occur due to improved survey accuracy?

For each cost category outlined above, estimate the range of costs that could result from errors and benefits.

RELATIVE IMPORTANCE OF DIFFERING TYPES OF SURVEY INFORMATION

On a scale of 1 (very low) to 10 (very high), rank the importance of the following survey purposes:

___ Sales satisfaction
___ Program evaluation
___ Marketing

Briefly explain the rationale.

What other purposes are made of survey information?

Survey information is usually reported and examined according to various categories (i.e., AFQT, age). For example, reasons for enlisting may be examined for each of the AFQT categories, for each sex, by age group, or by geographical region of the country.

To design a good sampling plan, it is useful to know the relative importance of these categories to those who use the information. Please rank order the importance of the following categories:

___ Command level (i.e., BDE, BN, CO, RS)
___ AFQT
___ MOS
___ Age
___ Race
___ Sex
___ Geographical area
___ Senior/Grad
___ Educational expectations

Are any other categories important? Which ones?

Does importance vary as a function of policy goals? Please give an example.

What improvements in the following areas would make this information more useful?

survey content -

methods -

sampling -
analyses -

data presentation -

What future events or needs might change the type, timing, or method of collecting survey information? (e.g., reduction in force, sustained conflict in Iraq, computers in RS, MEPS, etc.)

How important is the timing of when survey information is received?

What problems are associated with the use of survey information?

What problems are associated with survey sites?

At reception battalion?

At MEPS?

At recruiting stations?

What problems are associated with different survey methods?

Group administered?

Mail forms?

Telephone?

What problems are associated with sampling procedures?

What options are available for surveying individuals who do not contract?

QNEs?

PQs?

Appointments not tested?

SURVEY SPREADSHEET

How would it be useful to you?

estimating costs of additional surveys,

choosing alternative sampling plans and survey methods,

estimating sampling errors associated with alternative approaches

providing graphs, numbers to communicate decision rationales

evaluating competing contractor proposals

other reasons?

Who else may wish to use it and for what reasons?

What additional information do you need included in the spreadsheet?

What changes would make it easier to use?

Which features are most important?

Should a help-line tutorial be developed?

APPENDIX B

EXAMPLE ITEMS FOR SCALING TRADEOFFS BETWEEN COSTS AND ERRORS

Assume that the 2-year term option is within + or - 5% of new recruits for breaking even in terms of the program cost versus the number of additional man-years it produces. Assume also that 60% of the new recruits in last year's New Recruit Survey indicated that they prefer the 3 year option, 25% prefer the 4 year option, and 15% prefer the 2 year option. To obtain information to decide whether to retain the 2 year option for the following year, what is the optimum tradeoff between survey costs and acceptable levels of error in survey information?

	Survey Costs	Sampling Errors
a.	$250,000	2%
b.	$200,000	4%
c.	$150,000	6%
d.	$100,000	8%

The 1989/90 New Recruit Survey contained sampling error of + or -4%. Hence, due to sampling error, the percent of new recruits in the next survey who report being contacted first by their Army recruiter could decline 4%, with these results being due solely to chance, given the current survey sampling design. Given the relative importance of information concerning recruiter activities, what is the optimum tradeoff between survey costs (assuming the current tight budgetary environment) and sampling errors?

	Survey Costs	Sampling Errors
a.	$250,000	2%
b.	$200,000	4%
c.	$150,000	6%
d.	$100,000	8%